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The Harbor of Victoria and Vancouver, British Columbia

By H. Cole Estep

BURRARD INLET, British Columbia, and the two land locked bays leading from the Royal roads, Vancouver Island, together comprise the two largest and best protected harbors on the western coast of British North America. It is only natural therefore that on the shores of these bays should arise the two foremost cities of west-

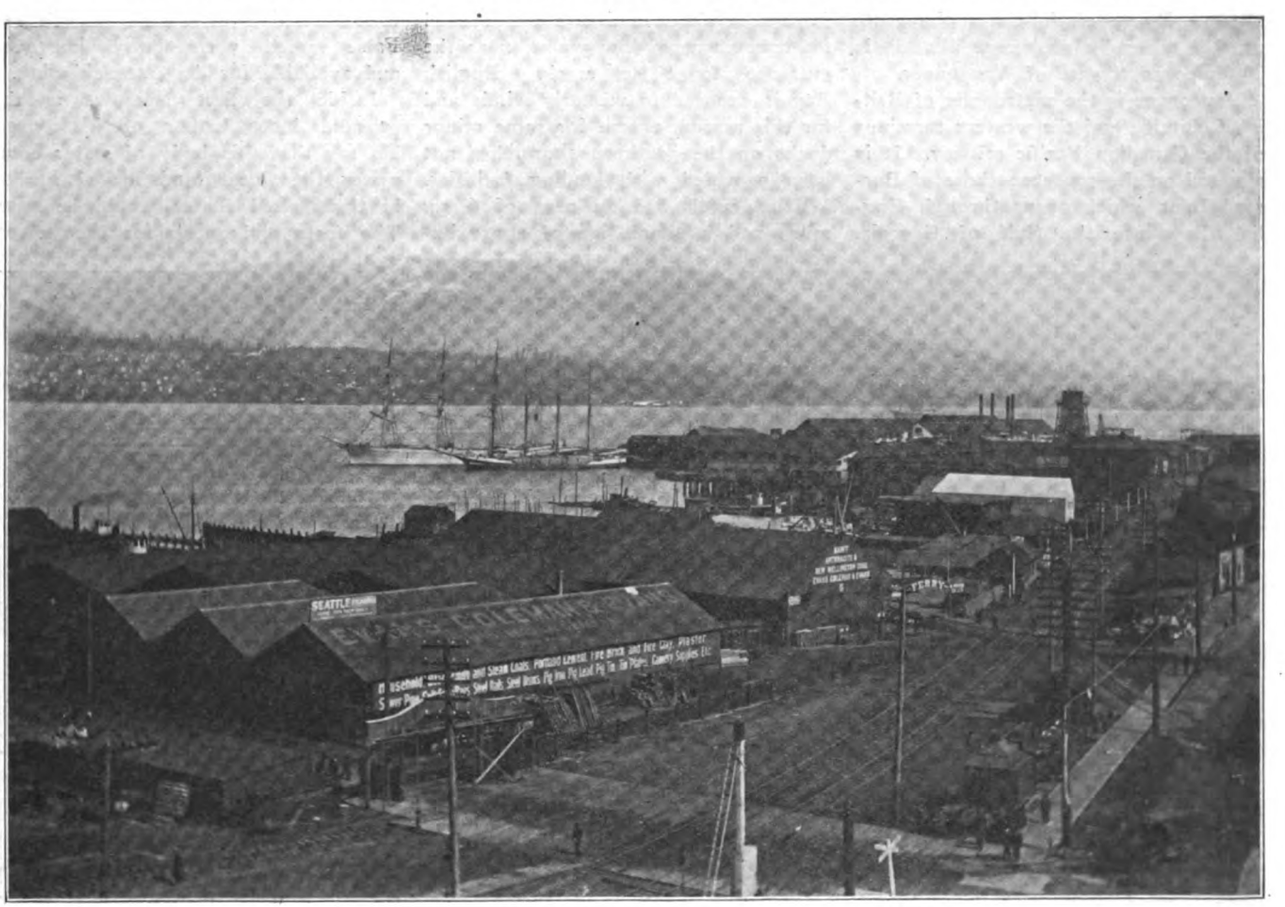

Fig. 1—Vancouver Harbor Looking East Toward Port Moody.

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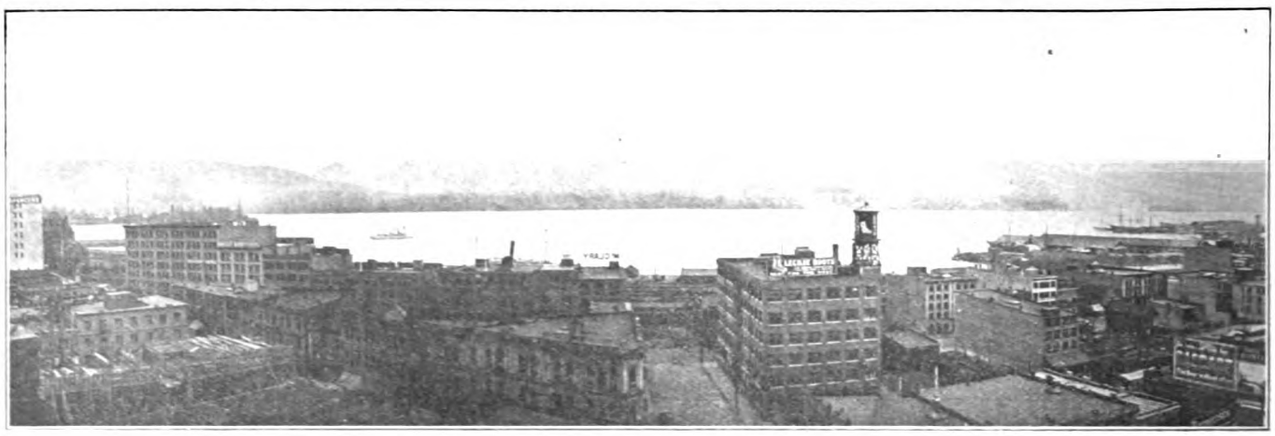

FIG. 2—BURRARD INLET FROM DOMINION TRUST BUILDING, VANCOUVER.

ern Canada—Vancouver and Victoria, B. C. A study of these two ports, which are only 80 miles apart, can be conveniently made in one article.

Victoria, the capital of the province of British Columbia and metropolis of Vancouver Island, is situated on two bays which indent the southeast coast of the island. By direct route through the Straits of Juan de Fuca, Victoria is only 70 miles from the Pacific ocean. Of all the harbors in the Puget Sound district, Victoria is closest to the sea. The harbor opens directly into the straits. By water, following the route usually taken by steamers, Victoria is 80 miles southwest of Vancouver.

Vancouver is the metropolis of British Columbia and the western terminus of the Canadian Pacific railway. It is situated on the southern shore of Burrard Inlet, which opens through English Bay into the Gulf of Georgia. The deep sea route from Vancouver to the far east and south is from the Gulf of Georgia to the Straits of Juan de Fuca and thence to the Pacific ocean. Vancouver is 178 statute miles due north of Seattle, Wash.

Vancouver harbor is divided by the First Narrows into an outer and inner harbor. The outer harbor consists of English Bay and False creek which latter inlet is reached through the southeast corner of English Bay. English Bay has an area of 15 square miles and an average depth of 12 fathoms with a minimum depth of 4 fathoms at mean low water, near the entrance to False creek. English Bay is exposed to westerly winds and for this reason, except for some minor docks on the southern shore, has not been provided with landing facilities.

False creek has an area of 6 sq. miles and a shore line of approximately 7 miles. It is intimately connected with the business and manufacturing districts of Vancouver and on this account will at some future time play an important part in the city's harbor development. At present False creek is too shallow to accommodate deep sea shipping. Plans, however, have already been made which provide for deepening the channel, building a retaining wall and preparing for a turning basin. A dredger is now at work and although the plans are not fully matured it is safe to assert that a few years will see False creek permanently improved and available for deep sea shipping.

Inside the first Narrows is the splendid inner harbor of Vancouver. To say that this body of water comprises the finest land locked harbor in the United States would be trite. The facts will speak for themselves.

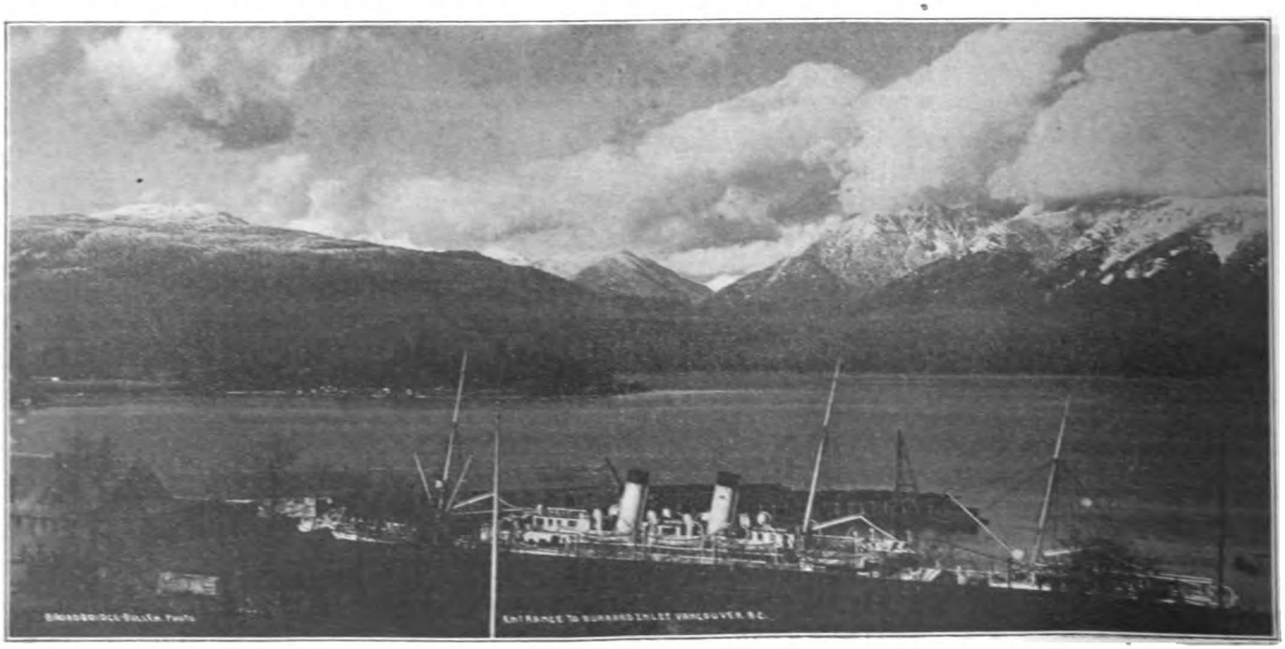

FIG. 3—ENTRANCE TO VANCOUVER HARBOR, C. P. R. DOCKS IN THE FOREGROUND.

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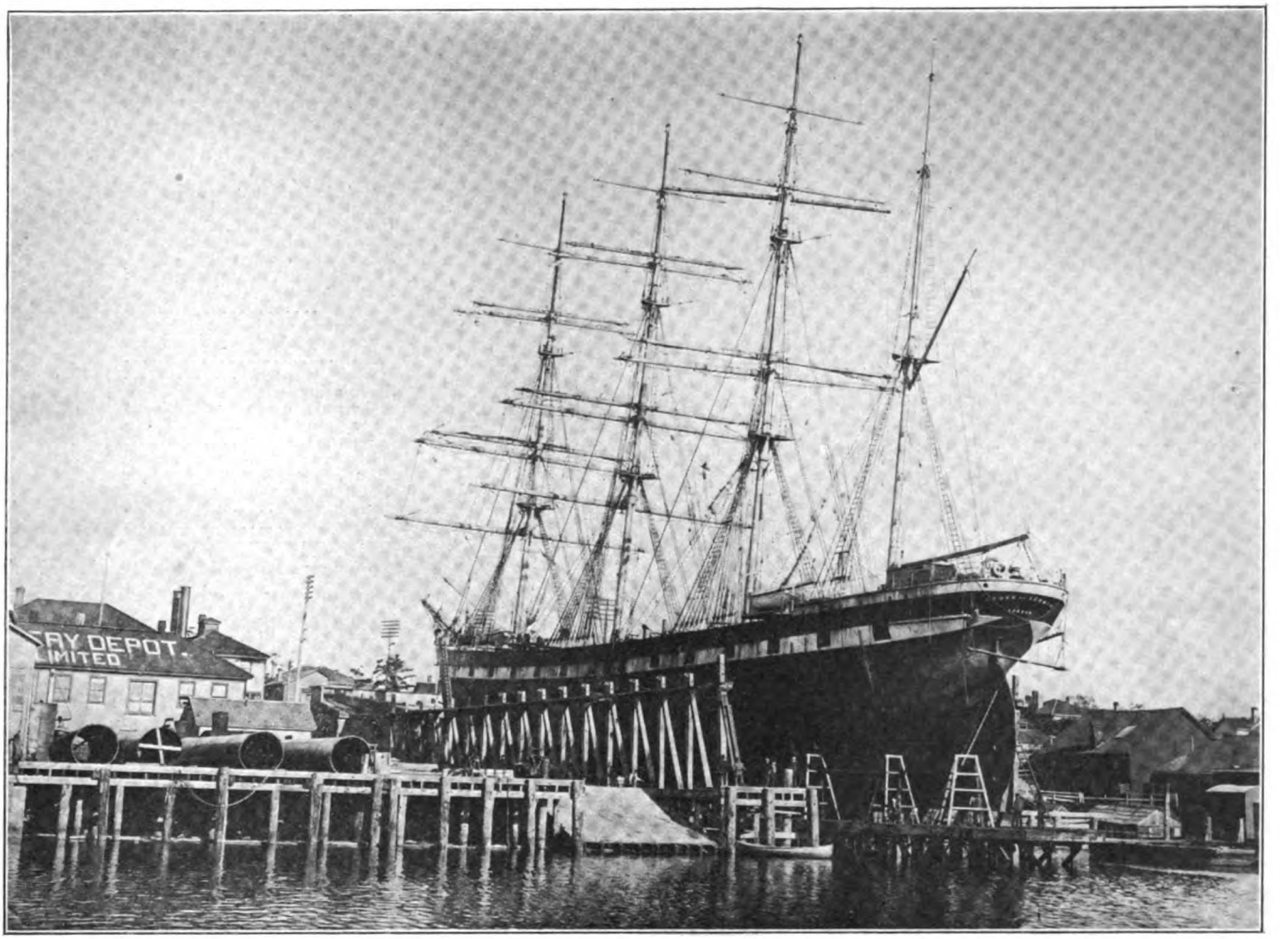

FIG. 4—MARINE RAILWAY OF THE VICTORIA MACHINERY DEPOT CO., LTD., VICTORIA, B. C. THE RAILWAY WAS BUILT BY CRANDALL, OF BOSTON.

The inner harbor consists of Burrard Inlet, Port Moody and North Arm. North Arm and Port Moody are separated from Burrard Inlet by a narrow, 12-fathom channel known as the Second Narrows. The whole inner harbor is protected on the north by a range of mountains rising almost abruptly from the shore and attaining a maximum altitude of 4,880 ft. On the south protection is afforded by a low range of hills and a wide stretch of wooded country. The protection from storms, inside the First Narrows, is absolutely complete.

Burrard Inlet, on the southern shore of which the city of Vancouver is built, has a shore line ten miles in length; the shore line of Port Moody is 14 miles and of North Arm is 22 miles, making the total shore line of Vancouver's inner harbor 46 miles. All of this is available for docks and wharves.

The average depth of Burrard Inlet is 14 fathoms, of Port Moody 10 fathoms and of North Arm 75 fathoms. The maximum depths of Burrard Inlet, Port Moody and North Arm are respectively 34, 14 and 103 fathoms; the minimum depths are, seven, three and 34 fathoms respectively. The water area of Burrard Inlet is eight sq. miles, of Port Moody eight sq. miles and of North Arm 11 sq. miles, making the total area of the inner harbor, 27 sq. miles.

The harbor is well buoyed and lighted. In fact the only drawback from a navigator's standpoint is the strong tide that makes through the Narrows. This current frequently reaches a velocity of five knots an hour, the tidal variation being 13½ ft. The strong tide, narrow channel and large amount of shipping sometimes combine to make the entrance to Vancouver's inner harbor dangerous. This is specially the case at night or in thick weather.

Vancouver is amply supplied with deep sea docks, these being all located on the southern shore of Burrard Inlet, between the First and Second narrows. The docks of the Canadian Pacific Railway alone have a frontage of 3,000 ft. All the docks have 26 ft. of water at extreme low tide. All the piers are provided with railway spurs and are built on the same level as the Canadian Pacific freight terminal yards, making the transfer of freight from cars to ships an easy matter. In conformity with the usual practice on the Pacific coast the piers are of wooden construction throughout. Vancouver's present dock facilities, with the exception of grain transfer elevators, are adequate and there is also room for an expansion of 800 per cent in the present dock frontage before the harbor will become congested.

While Vancouver has no steel foundries, its repair facilities are ample. It is well provided with gray iron and brass foundries, machine shops, sheet metal works and forging plants. There are a number of shipyards with marine railways of sufficiently large capacity to handle any ordinary coasting vessel. Among these may be mentioned the marine railway owned by the British Columbia Marine Railways Co., Ltd., which has a maximum capacity of 2,500 tons. A new 1,100-ton floating pontoon drydock is being built

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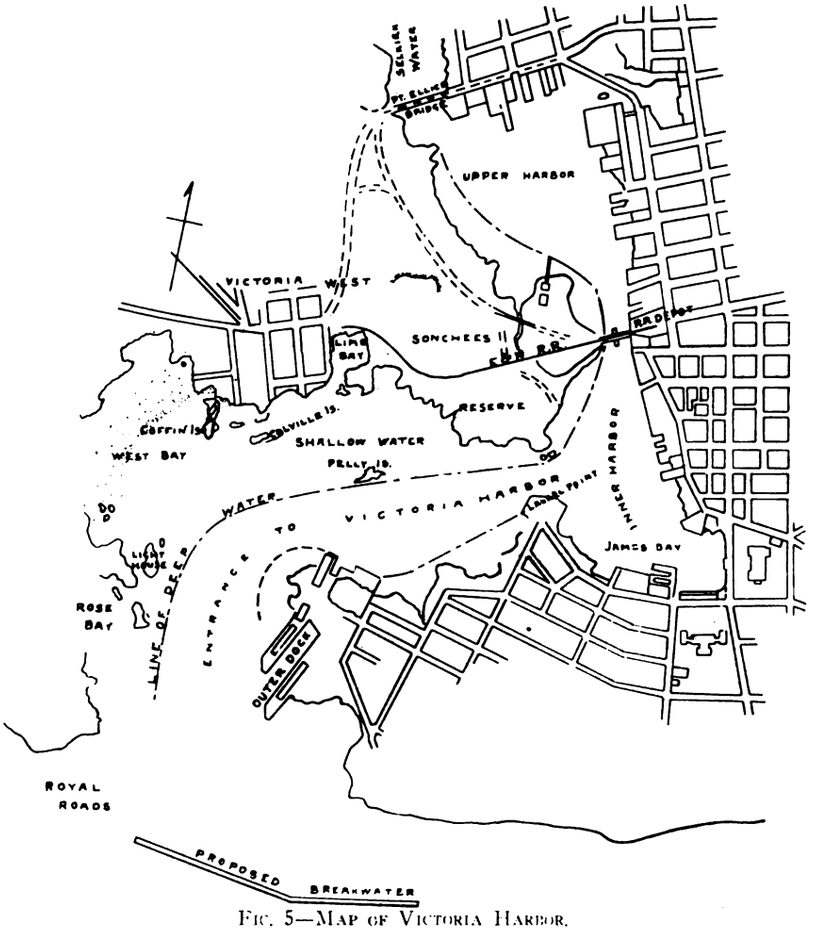

FIG. 5—MAP OF VICTORIA HARBOR.

in England for use in Vancouver harbor.

Vancouver is close to both the mines of the Wellington Colliery Co., miner of Comox coal and the Western Fuel Co., miner of Nanaimo or New Wellington coal. The Nanaimo mines are but 30 miles from Vancouver. The quality of the coal produced by these mines, as shown by the analyses given in Table I, is very good. The Comox coal is the best steamship fuel mined on the Pacific coast and is only slightly inferior to the best Atlantic coal. Nanaimo coal, as the table shows, is not greatly different from Comox. These coals are used successfully by the Canadian Pacific railway in their 25-knot steamships Princess Victoria and Princess Charlotte. The coal is brought to Vancouver in barges and stored in bunkers from which it is discharged into vessels. Close proximity to the mines and ample transportation facilities makes the maintenance of large supplies of coal at Vancouver unnecessary.

The ordinary dues of a vessel in Vancouver are shown in Table II.

TABLE I.
ANALYSES OF BRITISH COLUMBIA COAL.
From Reports of Provincial Mineralogist, Victoria, B. C.

Coal.	Moisture.	Volatile Matter.	Fixed Carbon.	Fixed Carbon and Volatile Matter.	Ash.	Sulphur.	B. T. U. per pound of Coal.
Comox, No. 5 Pit	1.32	27.62	63.64	91.26	6.7	0.72	14,191
Nanaimo	2.08	35.78	56.26	92.04	5.6	0.28	13,261
Comox Coke	0.74	1.26	80.60	81.86	17.40	....	11,215

There are six deep sea steamship lines, comprising in all 26 vessels, which have their terminus at Vancouver. These lines give Vancouver direct connection with the orient, Hawaii, South America, Australia and Europe. Five of the six lines sail under the British flag and one, the Chargeurs Reunis, under the French flag. In addition to the deep sea service there are eleven lines operating in the coasting trade. Nine of these lines are British and two are American. In addition to the regular service, Vancouver is annually visited by a large fleet of tramps, both steam and sail, in search of lumber, wheat or canned fish cargoes. The twenty-first annual report of the Vancouver Board of Trade shows that the saw mills tributary to Vancouver shipped 52 cargoes of lumber to foreign ports in 1907, aggregating 59,010,601 ft. board measure. Most of the cargoes were consigned to South Pacific ports, Asia or Europe. Out of these 52 lumber cargoes, 42 were in British vessels and only three in American

TABLE II.
ORDINARY DUES OF A VESSEL IN VANCOUVER.

Hospital dues, per register ton	$ 02
Health Inspector's fee	4.00
Harbor dues	5.00
Bill of health, outwards	1.00
Pilotage, per ft. (each way)	2.00
Pilotage, per ft. (steamers)	1.50
Port Agency (according to size)	$25.00 to 100.00
Discharge of ballast (usually done by ship's crew) or per ton	25
Harbor tonnage	10.00 to 20.00
Stevedoring—	
General cargo or salmon, per ton	45
Sugar, per ton	25
Lumber and timber, per M ft., according to the style of cargo and facilities of the ship	89 to 1.00
Watering	15.00 to 20.00

TABLE III.
ANNUAL SHIPPING OF VANCOUVER, B. C.
Fiscal year ending March 31, 1908.

	No.	Freight. Tons Reg.	Freight. Tons Wgt.	Freight. Tons Mst.	Crews.
Seagoing Vessels—Inwards with Cargoes.					
British	224	270,392	97,797	68,492	20,092
Canadian	199	103,540	8,333	799	6,693
Foreign	615	419,155	39,589	6,469	28,329
Total	1,038	793,087	145,719	75,760	55,114
Seagoing Vessels—Inwards in Ballast.					
British	42	81,282	.....	.....	2,422
Canadian	156	49,901	.....	.....	3,316
Foreign	100	70,560	.....	.....	3,299
Total	298	201,743	.....	.....	9,037
Seagoing Vessels—Outwards with Cargoes.					
British	172	288,318	82,519	112,458	16,162
Canadian	323	176,128	12,842	6,191	9,165
Foreign	435	343,209	29,666	20,805	20,506
Total	930	807,655	125,027	139,454	45,833
Seagoing Vessels—Outwards in Ballast.					
British	47	57,397	.....	.....	2,604
Canadian	189	45,376	.....	.....	3,257
Foreign	268	139,985	.....	.....	10,994
Total	504	242,758	.....	.....	16,855
Coasting Trade—Inwards.					
Steamers	4,188	674,395	.....	.....	61,934
Sailing Vsls.	262	233,068	.....	.....	1,457
Total	4,450	907,463	.....	.....	63,391
Coasting Trade—Outwards.					
Steamers	4,334	650,324	.....	.....	66,665
Sailing Vsls.	265	234,101	.....	.....	1,463
Total	4,599	884,425	.....	.....	68,128
Grand Total	11,819	3,837,131	270,746	215,214	258,358

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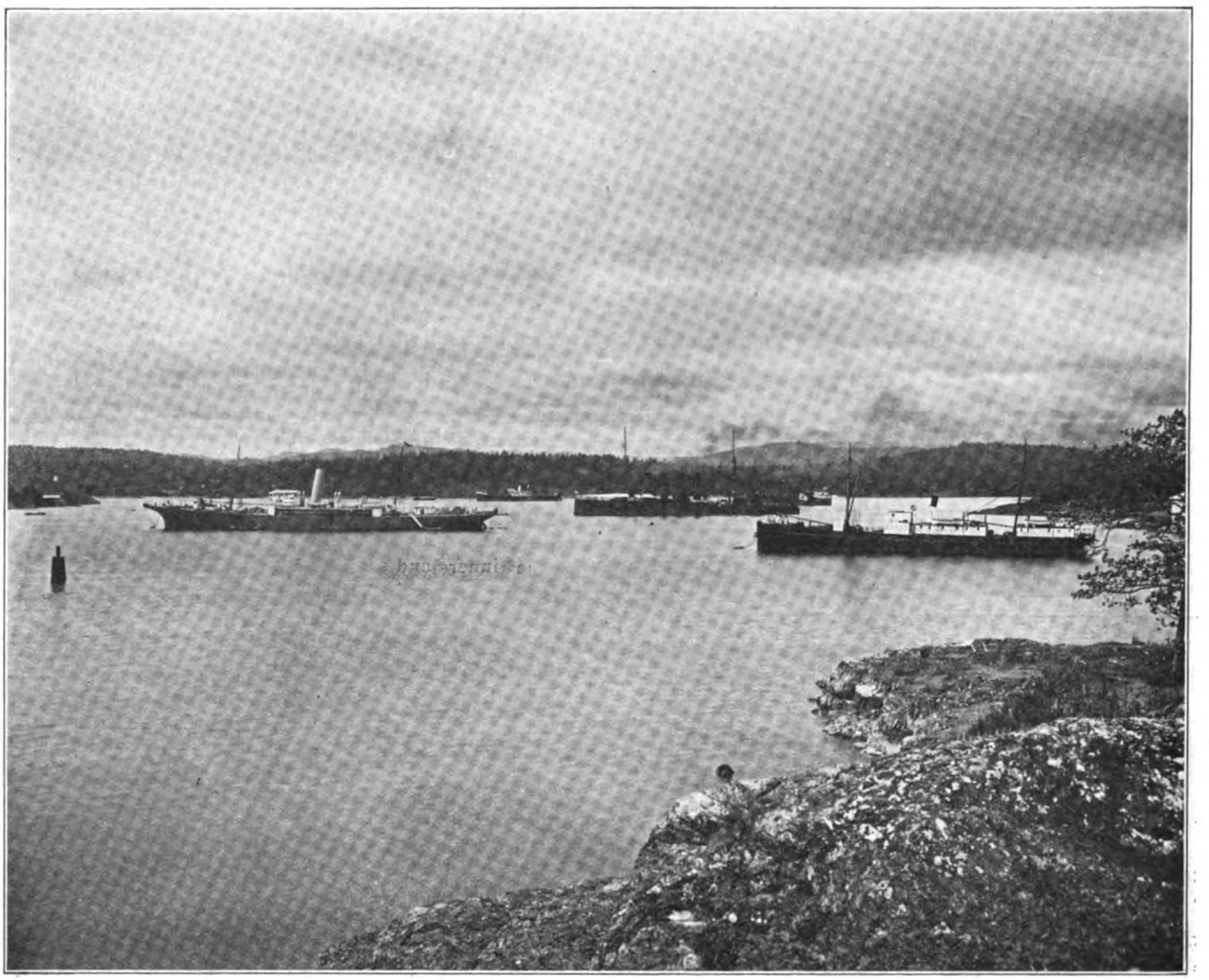

FIG. 6—ESQUIMALT HARBOR, VICTORIA, B. C.

bottoms. Table III shows in detail the annual shipping of the port of Vancouver.

Victoria.

The Royal Roads is the name given to a large, semi-protected bay situated on the extreme south-west coast of Vancouver Island, British Columbia. This bay has an area of six sq. miles, an average depth of 16 fathoms and is situated on a line bearing W ½ N from Point Wilson, Clallain county, Washington. The Royal Roads are guarded on the east by Albert Head and on the west by Clover Point. From the head of this bay lead two splendid, landlocked harbors surrounding which is built the city of Victoria, British Columbia. The larger of these two harbors is known as Esquimalt and the smaller as Victoria Harbor. At present the commercial developments are almost entirely confined to Victoria harbor. Esquimalt is the seat of a British navy yard and is also the site of several marine railways and ship repair firms.

Esquimalt harbor is reached from the Royal Roads through a channel ⅜ of a mile wide, free from obstructions and nine fathoms deep. The harbor itself, which is completely landlocked, has a water area of two sq. miles, a shore line of about six miles, an average depth of five fathoms and a maximum depth of nine fathoms. The center of Esquimalt harbor is approximately three miles on a straight line from the custom house at Wharf and Government streets, Victoria. The shores of Esquimalt are rocky but the anchorage, particularly at the eastern end, is good.

Victoria harbor, which is much more intimately connected with the commercial activities of the city than Esquimalt, consists of three parts, named successively the outer harbor, the inner harbor and the upper harbor. The entrance is sinuous and narrow, but has been greatly improved by dredging and blasting. All dangerous rocks and obstructions except Pelly Island have been removed. Fig. 5 presented herewith clearly shows the general layout of Victoria harbor. At present there is a depth of from 18 to 20 ft. at low tide extending from deep water outside to the Canadian Pacific wharf in the inner harbor. The depth of the upper harbor is from 15 to 20 ft. at low water on the east shore and from 4 to 6 ft. on the west shore.

The navigable area of the outer harbor or entrance is one sq. mile and the shore line is three miles. The area of the inner harbor is 55 acres and the shore line 4,500 ft. The area and shore line of the upper harbor are 48 acres and 9,000 ft. respectively. The average tidal variation in Victoria harbor is about 7 ft. The velocity of the tidal currents in the narrows opposite Laurel point reaches approximately five miles per hour. At other points the tidal velocities are not specially noteworthy.

Ocean going vessels do not enter

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Victoria harbor beyond Shoal point. The various ocean docks are all outside of this point where the minimum depth of water at low tide is 30 ft.

TABLE IV.
PORT OF VICTORIA.

For the 12 months ending June 30, 1909.

Imports	$4,546,834.00
Exports	1,539,509.00
Customs collections	1,331,238.33

SHIPPING.

Statement of vessels employed in the coasting trade of the Dominion of Canada arrived at and departed from the port of Victoria during the 12 months ending March 31, 1909:

Vessels arrived.			Vessels departed.		
Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.
2,401	1,075,901	60,263	2,392	999,001	66,575

Vessels entered inward from sea during the year ending March 31, 1909:

With cargo.			In ballast.		
Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.
903	856,756	55,728	865	497,063	19,696

Vessels entered outward to sea during the year ending March 31, 1909:

With cargo.			In ballast.		
Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.
575	588,937	34,014	654	830,817	41,204

Table IV gives details of the vessels entering and leaving Victor harbor for the year ending March 31, 1909. The total imports of the Port of Victoria for the fiscal year 1907-8 amounted to $4,971,045 and the corresponding exports totalled $1,114,729. The commerce of Victoria, in common with that of other Pacific coast ports, is growing at an astonishing rate. An examination of recent custom house reports indicates that this increase amounts to approximately 20 per cent per annum.

To handle this traffic docks and wharves have been built along the available shores of Victoria harbor from the harbor entrance to the head of the upper basin, giving a total wharf frontage of 6,000 ft. Most of the docks in the upper harbor basin are connected with mills, shops, or other industrial establishments. This leaves only those in the inner and outer harbor available for general commercial shipping. The principal wharves devoted to this traffic are as follows: Turner, Beeton & Co.'s wharf, The Hudson Bay Co. dock, International Steamship Co.'s wharf, Canadian Pacific Railway Co.'s docks and the outer wharves controlled by R. P. Rithet & Co. These latter docks have a frontage of 2,564 ft., a warehouse area of 19,340 sq. ft. and a minimum depth of water of 30 ft.

The docks enumerated have ample warehouse area and facilities for handling the present traffic, but if the business of the port continues to grow (and there is no reason why it should not), the existing dock facilities will soon be entirely inadequate. The port of Victoria, by virtue of its growing trade and the relatively limited area of Victoria harbor, is therefore face to face with the problem of increasing its wharf and warehouse facilities.

The work of providing the necessary additional facilities has been taken up by two organizations, the Victoria, British Columbia, Board of Trade and the Inner Harbour Association of Victoria. The latter body, which was specially organized to prosecute the improvement of Vic-

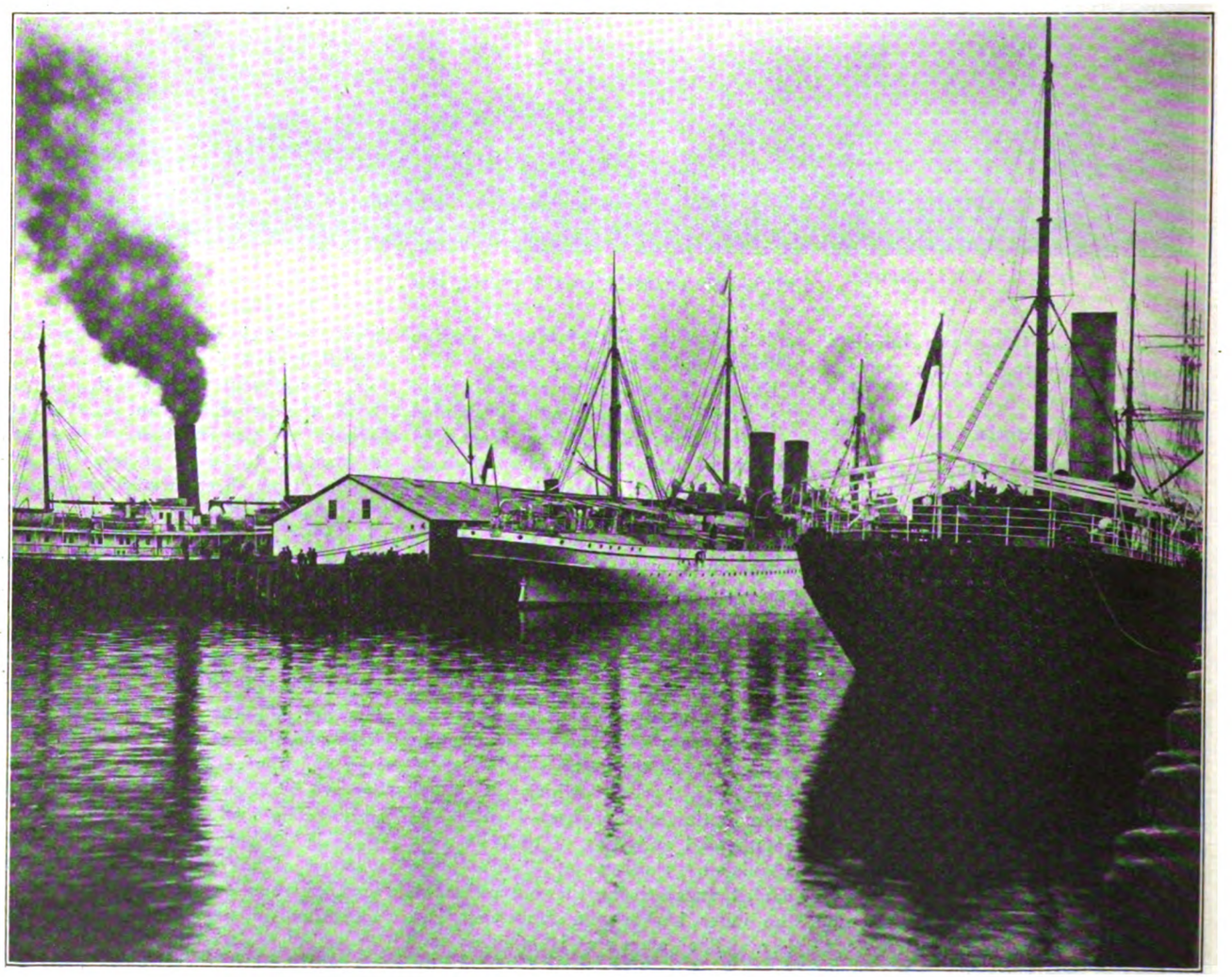

FIG. 7—DEEP SEA WHARVES OF R. P. RITHET & CO., VICTORIA, B. C. PHOTO BY FLEMING BROS., VICTORIA.

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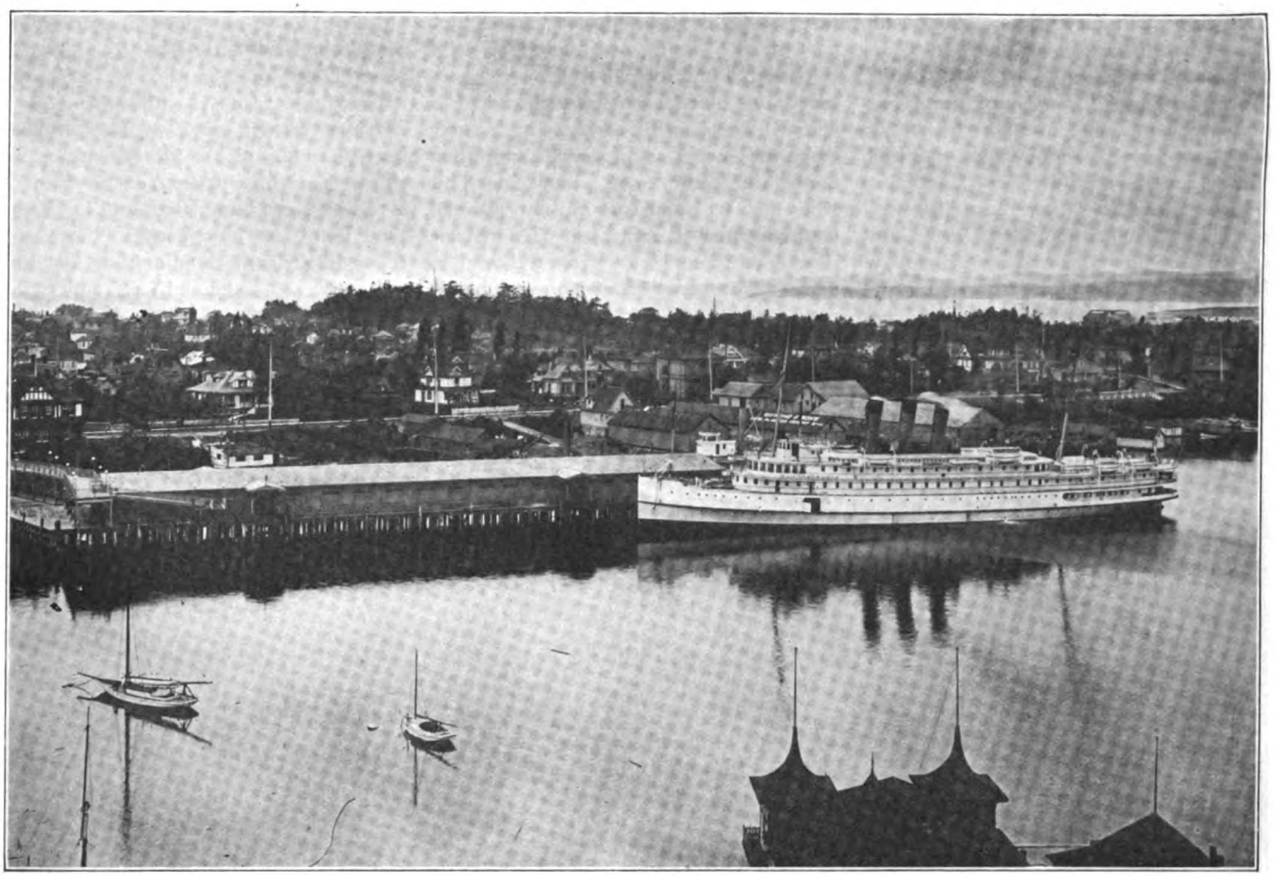

FIG. 8—CANADIAN PACIFIC RAILWAY WHARVES, VICTORIA, B. C. PHOTO BY FLEMING BROS., VICTORIA.

toria harbor, has been particularly active.

Two general schemes of harbor improvement are being advocated, each having for its main object an increase in the area available for wharves and warehouses.

One plan involves the building of a stone breakwater in deep water beyond and south of the outer wharves. This breakwater, shown in Fig. 1, would cost approximately $1,125,000 and would protect the outer harbor from all southerly storms. In this way a considerable area, depending on the extent of breakwater, would become available for additional deep water wharves.

The second plan includes dredging and removing obstructions from the inner harbor and upper basin, making a free channel with a minimum depth of 25 ft. from the open water in the Straits to the head of the upper harbor basin. Through the efforts of the Inner Harbour Association considerable work has already been done in this direction and arrangements have been made looking toward the completion of the entire project within three years. At present, on account of shallow water, the western shore of the harbor is not available for warehouses and wharves. Part of the work now under way includes filling in this shallow shore and building a retaining wall. In the upper harbor alone, 1,250,000 cu. yds. of mud and 10,000 cu. yds. of rock will be removed, 500,000 cu. yds. being used for the fill behind the proposed retaining wall. These improvements will increase the depth of the harbor, enhance its safety and add 100 per cent to the available shore line suitable for building wharves, bunkers and other harbor facilities.

It is probable that the growth of Victoria's commerce will soon make both the outer breakwater and the inner harbor improvements necessary and will in addition require the use of Esquimalt harbor for deep sea shipping, for which purpose it is admirably suited.

Repairs and dry docking facilities are better at Victoria than at any other British Columbia seaport. There is a government navy yard at Esquimalt equipped with a large graving dock, open at all times for commercial work and in addition there are three marine railways ranging from 180 to 300 ft. in length. The dimensions of the Esquimalt graving dock are as follows: Length of dock to gate, 450 ft., level with the keel blocks; width of gates, 65 ft., depth of water varying from 27 ft. to 29 ft. 6 in. according to the season of the year. The following table gives the charges for the use of this dock:

Gross Tonnage of Vessel.	For the first day of docking.	For each following day day including undocking day.
For all vessels up to 1,000 tons	$300.00	5 cents per ton.
From 1,000 to 2,000 tons	350.00	4½ cents per ton.
For all vessels above 2,000 tons	400.00	4 cents per ton up to 2,000 tons and 2 cents per ton on all tonnage above 2,000.
Vessels from 430 to 450 ft. in length	550.00	
Vessels from 450 to 480 ft. in length	700.00	

The Esquimalt marine railway, controlled by the British Columbia Marine Ry. Co., Ltd., has a cradle length of 300 ft., a beam of 60 ft. and a capacity of 3,000 tons; a second marine railway controlled by the same corporation is 180 ft. in length, 42 ft. beam with a capacity of 1,000 tons. The Marine railway of the

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Victoria Machinery Depot Co., Ltd., is 280 ft. in length and 69 ft. 2 in. beam. It has a capacity of 3,000 tons. In connection with each of these marine railways efficient and completely equipped repair shops are operated. The plant of the Victoria Machinery Depot Co., Ltd., is unusually well equipped. This plant has been recently rebuilt and now includes a foundry, machine shop, forge shop and boiler shop provided with the latest, approved machinery and appliances.

In conclusion we cannot do better than quote the words of Charles H. Lugrin, editor of the *Victoria Colonist,* in regard to the remarkable advantages to the navigator offered by the Straits of San Juan de Fuca, which waterway, it will be remembered, forms the connecting link between Victoria, Vancouver, Seattle, Tacoma and all other Puget Sound ports and the Pacific ocean. Mr. Lugrin says: "This remarkable waterway is destined to play an important part in the history of the Northwest coast. No matter what developments may take place elsewhere, through its waters fleets will always find their way, for by it are reached numerous important centers of population and also the terminals of nearly all the transcontinental railways. The Strait is a part of a great structural valley, due to the operation of some tremendous forces in by-gone time. It extends inland on the continent as far as the Hope Mountains, although the upper part of it has been filled with silt and other detritus brought down by the Fraser. It has two great ramifications. One of these is to the North and terminates at the head of Bute Inlet. The other is to the south and extends far down into the State of Washington. Captain James Cooper, R. N., gives the following general description of the Strait: "The geographical features of the Strait of Juan de Fuca are most important to the commercial interests of the Northwest Coast of America, carrying an average width of ten miles from Cape Flattery for 50 miles to Race Rocks, here in consequence of the American shore trending northward the breadth is contracted about two miles. From this point the Vancouver shore recedes in a northerly direction for nine miles toward Esquimalt, off which the Royal Roads extend for three miles offering to all vessels a splendid anchorage when required." Captain Devereaux wrote of the Strait and the soundings off its entrance: "Nowhere else on this coast are such soundings to be found. In fact, they are to the Strait of Juan de Fuca what the Banks of Newfoundland are to the Gulf of St. Lawrence, a safe and valuable guide to the mariner approaching the land in thick weather, and by attending to the lead and using ordinary precautions, the navigator

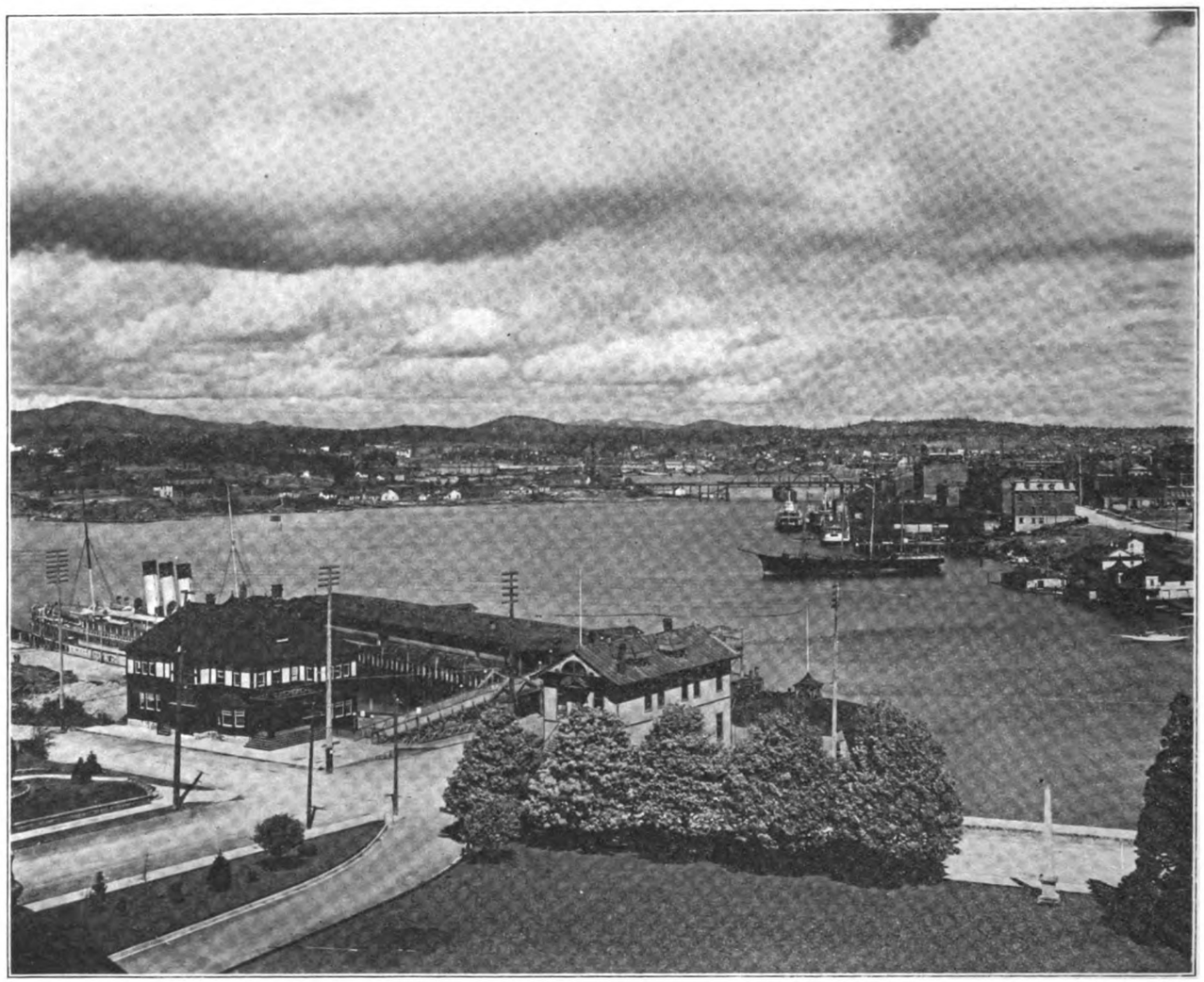

FIG. 9—THE INNER AND UPPER HARBORS OF VICTORIA, B. C. THE UPPER HAREOR IS SHOWN IN THE BACKGROUND BEYOND THE DRAWBRIDGE.

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can find his way into and through the Strait, as there is a deep water zone, 100 fathoms, running eastward mid-channel until Race Rocks are passed, where it shoals to 60 or 70 fathoms. This deep water shoals rapidly to 20 fathoms about two miles off shore on both sides of the Strait, and at a distance of one mile 6 to 10 fathoms will be found and carried right up to the cliffs, as there are no outlying dangers except Race Rocks." I am aware that the entrance to the Strait and the Vancouver Island coast lying to the north have been called "the graveyard of the Pacific," but it is safe to say that there is no disaster on record, which could not, if the facts were known, be traced to some fault either in the ship or those responsible for her safety, even when the safeguards to navigation were not equal to what they now are. A well-found ship, efficiently officered, will find the Strait of Juan de Fuca not only free from exceptional perils but one of the safest of all waterways.

"It is obvious that the position of Victoria in relation to that great artery of travel described in the last paragraph, namely the Strait of Juan de Fuca, is one of very much importance. This city necessarily possesses for the purposes of deep sea navigation every advantage enjoyed by ports further from the ocean and is free from certain disabilities arising from more or less narrow and tortuous channels."

THE NAVAL WASTE

III*

A walk through any navy yard will disclose equipment costing huge sums for doing work it almost never has to do. Just an instance. In the League island yard, in a fine steel building, with tile roof and all that belongs therewith, stands a magnificent hydraulic bending press, built to navy specifications and which has not its counterpart in any ship building plant the writer has visited, *not even those who built the ships* for whose repair it is installed. The same machine, if built for the most exacting industrial concern, would cost thousands less; this on the authority of its builder. I make this statement: that *the interest on its cost,* including, of course, installation, will do all the work for which it is intended and for which it was installed, and *do it by hand with improvised appliances.* One trouble with the navy is that it cannot do anything like anybody else or with the same or similar means. One would think that in an expensive tool, which in the nature of things cannot be used but seldom even in the building of ships, and, like every other tool known to the trade or in the history of it, is certain to be improved upon, some attempt would be made to use standard designs. But the minute the navy wants anything, from a paper of tacks up, it loads its specifications with a mass of fool restrictions and requirements as to design, materials and workmanship, tests, etc., which make the cost vastly greater than the standard tool could be had for. It is right and proper that the national service should have the best of everything, but that does not carry with it the right to squander millions to please the whims and fancies and crazy notions of department employes on officers. The department has no one within its jurisdiction who is half as well qualified to say what is best for its service as those whose daily competitive struggles have developed the appliances which they (the navy) are not satisfied with. There is no one thing connected with the building or equipping of a naval ship that industrial concerns are not equipped to do, and tools and appliances that are suitable and good for them are plenty good enough for the navy or the people who have to use them.

*See introductory note in August issue.

Rejection of Material.

Take the matter of steel for shipbuilding (not armor, remember) for instance, and note why the department has to pay more for it and get inferior service and deliveries and the job is not a whit better in the end. The bureau of construction reports that during the last year it inspected 63,823 tons of steel, of which it *rejected over 34 per cent.* Of that accepted there was 13,445 tons of scrap (shearings, trimmings, etc.,) and there was actually shipped 28,494 tons, a little under 45 per cent of the total. Of the rejected material over 70 per cent was on account of "surface defects". There is not a ship builder or designer in the country who would not unhesitatingly accept 90 per cent of the plate the government rejects for "surface defects". Even the scrap in the navy plate is a much higher proportion than in first class commercial work. To say that 34 per cent of the product of even the worst mill in the country is not fit for naval ship building is drivel. The navy does not need for any reason, and is not entitled to, any better material than is accepted by any of the standard classification societies or insurance companies for shipbuilding. This has nothing to do with armor, bear in mind, but for all the under water and interior work, and in fact the entire structure excepting armor. Even a bit of plate for an ash bucket or a garbage spout is subject to the same ridiculous restrictions as one of the most important shell plates. Steel companies in periods of good business do not want the orders at all; their execution interferes with their regular run of work and reduces their output, and the inevitable consequence is a boosting of the price. The hull of one of our battleships is not worth one cent more to the country than if it were built of the same material as any old tramp carrying a classification certificate, and besides, as before remarked, the battleship is discarded before the tramp has ceased to be a profit earner.

The route of the various government departments is strewn with the wrecks of concerns who had established a reputation for good and honest work long before the advent of the academy cub who came to dwell among them when, in an evil hour, they bid on and were unfortunate enough to secure government work. It is only right however, to add that not all these are the work of the navy; the army has done its share, but the trail of the serpent is over them all.

Senseless Duplication.

There is, too, a needless and senseless duplication. In the various navy yards the different bureaus have each their independent shops and equipment. Thus we find that the bureau of steam engineering has its pattern shops, foundry and machine shops, and across the way the bureau of construction or the bureau of equipment will have others fitted for doing the same kind of work, sometimes even separate power plants. In each we will find

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similar tools and appliances seldom even needed, but nevertheless once in a while some operation requires, or can be done by, a certain tool, so each must have it. The idea of one bureau calling upon another to help out is discouraged as much as possible. I saw in one shop a very handsome tool which is not usually found outside of shops making a certain line of machinery not in a remote sense connected with naval work, and asked the foreman what he used it for and was told that it had never been used since it was installed and that there was a tradition about the yard that some official had been jestingly told that they ought to have one and it was bought. This may or may not be the truth, it is immaterial, there are things more important, but all this foolish pride and ignorance the country pays for.

That there is some sense of inefficiency is indicated by the occasional effort to justify expenditures. Thus a reference to the new steel casting plant at the New York yard says "the price of castings made therewith have compared favorably with those purchased on contract". Another statement which cannot possibly be unintentionally misleading, but is misleading nevertheless. We have no quarrel with the navy owning its own steel casting plant, although we object to the cost of it, but the foregoing statement is deliberately made and is not even an approximation to the truth. In the first place, as already stated, the product does not carry any charge for salaries or "civil establishment," or taxes, interest on investment, depreciation, power, insurance, etc., while the castings purchased outside carry, besides all these, freight, inspection, replaces, and a profit to the manufacturer. Moreover, it is an open secret that the inspection on the yard-made castings does not approach that imposed on the manufacturer and that castings are passed and used that would be promptly condemned if bought outside. I have seen some of them myself. The report is altogether too modest, there is no reason why the outside castings should have any standing whatever in such a comparison.

The bookkeeping and purchasing end of the department is the bureau of supplies and accounts, the duties of which are purely clerical and of routine, not executive or discretionary, but its records are instructive. A glance through its schedules will disclose dozens and scores of items for which congress appropriated the money years ago and on which little or nothing has been done, yet this has no effect on the constant cry for more. This bureau acts as general storekeeper of all supplies and materials, and carries separate stocks and accounts for each of the other bureaus. Occasionally we will run across advertisements for some small items of supplies for some particular bureau while probably within 50 yards another bureau has lying unused a supply of this very same material. Not long since I saw advertisements in a number of trade papers for a small quantity of common sheet rubber for one of the bureaus of Mare Island yard. The bureau of steam engineering probably had in its store rooms in the same yard a half ton of the same thing. The advertisement probably cost some hundreds of dollars; trade papers do not sell their space for low prices. I had the curiosity to follow the matter up and found that the low bid was under $25 and the high not much above $30. The schedules are full of others equally glaring. How such a system can maintain a foothold in a country that claims to be progressive is "one of these things no fellow can find out."

The Navy Does Not Get Returns.

With all the advantages of highest priced equipment the navy does not begin to get equal returns in labor or output for money expended with industrial concerns on similar work. This is partly due to incompetence and lack of knowledge in those charged with direction, which knowledge cannot, and never will, be gained where the incentive of competition is absent. The dominating thought in every concern whose existence depends upon its ability to earn a profit is to reduce cost and save money, while on the other hand, in the navy, it seems to be to secure appropriations and spend them. There seems to be a lack of knowledge of expeditious, economical methods or of ambition to utilize them. But that is only to be expected. The department never can get the services of the brightest and most ambitious mechanics because it has nothing to offer beyond a day's pay. There is no promotion for the man who has brains and will use them.

A petty foreman's position, under some cub from the academy, is the limit. The navy yard is the refuge of the incompetent and the home of the derelict. This does not mean that there are not good workmen in our navy yards, there are a few, but they are content where they are; ambition is not there. An instance of this will serve to illustrate how little value time and thought have in the naval service.

Repairing the Destroyer Hopkins.

In December, 1906, the destroyer Hopkins came into Key West with both propellers damaged, necessitating their removal. She had tried an overland route with the usual results. Notwithstanding there are at Key West at least two marine railways that could have taken her stern out without difficulty, a diver was set to work to get them off afloat. He used up two weeks on the job, only succeeding after the hubs of both had been split by drilling with a ratchet by hand under water. Now these propellers are taper fitted and supposed to be easily removable but as they lay on the wharf the writer had the curiosity to measure the amount of taper and found about half an inch in a length of about 20 inches. No wonder they could not be withdrawn. Two months later, during the whole of which time the boat lay there with her crew aboard, her officers had received no information as to new propellers. While lying in a slip with her stem projecting about 20 ft. beyond the dock line, the Vesuvius, in attempting to come alongside the dock, collided with her and cut her to the center line. Mattresses and canvas jackets were got over and the under-water opening stopped and repairs were undertaken. As is well known these boats are of very light construction; at that point ⅛ or 3/16-inch plate or, as known in the trade 5 lb. or 7½ lb. plate. The last the writer saw of the work a float was alongside while an officer and two or three foremen and a number of the crew watched two workmen with a 6-lb. sledge and a diamond point chisel attempting to cut adrift the damaged plate. Now an amateur would scarcely need to be told that on such a light material no progress could be made in that fashion. A hand hammer and one man would make feet of headway where the sledge and two men made inches. But the ideal tool would have been a pneumatic hammer, which would have used minutes where even the hand hammer would have used hours, and with these tools in the shops and the air compressor already aboard the boat, everything was at hand for expeditious work, but if anyone knew how to take advantage of them they kept quiet about it. The same medium, with a pneumatic drill would have done in two or three hours under water what the diver took many days to do by hand. And yet the apologist says criticism is unwarranted. It may be unnecessary to refer to

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the Connecticut, built in the New York navy yard, which, begun under the same appropriation as the Louisiana, built in a private yard, and with the whole resources of the yard and of the department employed in the effort to excell the contractor who had much other work to carry along at the same time, was almost two years later going upon her official trials and then did not equal the Louisiana.

Difficult to Get Men for the Navy.

We have read time and time again of the difficulty of getting men for the navy. We have spent enormous sums in advertising and in recruiting and in telling the public how well treated the men are and what a pleasant life they lead "on shore duty, at sea, and in our island possessions." We are told that no abusive language and no profanity is allowed to be used by officers to enlisted men. That is a deliberate and unqualified misstatement of the facts. The writer has stood and watched a drill sergeant drilling a squad of raw recruits at League Island, in the hearing of a superior officer, and heard him use the foulest and most abusive epithets to the men I ever listened to from one man to another; such language as he, unprotected by his uniform, would not have dared to whisper to any man in the squad. This is the hardest thing to have to say, but it is the truth, and it is right and proper that the people of the United States should know it. Before we pour another hundred millions into the gaping maw of our navy let us know the whole story. Only a part of it has been told and the surface has not been scratched.

The Navy's Needs.

The author yields to no one in his belief in and advocacy of a navy, and the best, not judged by Russian standards, but he does not believe in the policy of appropriating year after year whatever the navy asks for. It is time a halt was called and the brakes applied. There is not a statement made herein for which the departmental reports and records do not furnish confirmation or which will not be borne out by investigation at the hands of competent practical shipbuilders, not a board detailed from the ranks of the defendant department. It is said that 65 per cent of our total revenues are appropriated to the army and navy and pensions. As to the army the author disclaims much actual knowledge and as to pensions has nothing to say, but if the expenditures are all as well advised as those for the navy it is time the whole business was raked fore and aft and athwartship.

As to the navy's needs, that is a question to which there are as many answers as there are points of view. The designing of fighting ships can best be done by those who are specialists and those who have to use them, it is mostly guesswork anyway, and that there will be differences of opinion goes without saying, but the unseemly squabbling over the designs and the responsibility for them, as disclosed by the departmental reports, should not be tolerated. Thus it appears, for instance, that the designs for the Tennessee were not completely decided upon when her construction was begun, and were *changed four times,* and each of the bureaus involved accuses the others of being responsible for it. But there is one point of view upon which all can agree, efficiency, and that involves administration as well as design, and the getting the utmost possible value for the money provided. It has always seemed to the author that what the navy needs more than anything else is a little of the horse-sense and practical business knowledge, in a word, *execution,* which can only be acquired outside the sanctified precincts of the department and amongst concerns where the spur of competition is continually felt and to fail is to fall.

* * * * * * * * *

The foregoing was written in February last (1908), but the author afterwards decided not to make it public. Since that time developments have led him to alter his decision. The Pacific cruise, as first planned, has come to an end; the reports of commanding officers have borne out in great part the criticisms so vehemently denied at the time; the unreliability of a fleet of foreign colliers has been forcibly exemplified; the spectacle of a great fleet of warships on the Pacific whence almost the last American merchant steamer has disappeared has been presented; the usual amount of fulsome gush over the "magnificent performance" has filled the daily press; the usual months of refitting at navy yards has followed the leisurely excursion; and Admiral Evans has informed us that what we need is two complete fleets of 24 first class battleships each. As it was shown at the last session of congress that in view of recent developments in battleship design we now had scarcely one entitled to rank as such, we may prepare for the announcement of a program involving the expenditure of upwards of $300,000,000 on new construction. In April last (1908), the author, in a contribution to a marine journal on the subject of navy supervision for the merchant marine, called attention to the cost of naval colliers and the time required for their building. Whether or not as a result, the department almost immediately afterwards asked for bids on *three 7,200-ton colliers of 12 knots speed,* and as these lines are being written a contract has just been awarded to the Maryland Steel Co. for the three ships at $490,000 each, or $1,470,000 for the three, *$80,000 less than the navy asked for to build one,* or than the author claimed herein they could be built for. As to time; the first ship is for delivery in ten months, all three in 12 months. The Vestal and Prometheus have now been building over four and a half years and are not anywhere near completed yet. Such prompt confirmation of the author's charges seemed to justify the publication of the entire article.

MANILA HARBOR.

According to Lieut. A. B. Wyckoff, of the United States hydrographic office at Port Townsend, Wash., the artificial harbor behind the breakwater at Manila has a depth of about 30 ft.; the anchorage is fair, but all the regular liners have mooring buoys. The chart used is the U. S. Coast and Geodetic Survey, published in 1909, which is perfectly reliable. Pilots are not necessary.

At present there are no harbor improvements under way and none are contemplated in the immediate future. Ships, upon arriving at Manila, are assigned berths by the custom house berthing master. The harbor regulations are issued by the collector of customs; the quarantine rules are the same as those in force in the United States; there are no port charges for foreign going vessels.

Manila has two small marine railways and no drydocks. At Olongapo, however, is the U. S. naval drydock Dewey capable of taking on a large battleship and at Cavite is a marine railway 240 ft. long having a capacity of 2,500 tons.

The facilities for the repair of wood or steel vessels are fair, but the prices are high. Iron and brass castings up to eight tons can be delivered by the local foundries, but there are no plants producing steel castings. The wrecking outfit and appliances are fair.

There are three government wharves in the harbor, each 600 ft. in length and 30 ft. in width. Most of the freight is transferred by lighters at a charge of $1.00 per ton, Philippine currency.

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HUDSON-FULTON CELEBRATION

Photos by Edwin Levick, New York

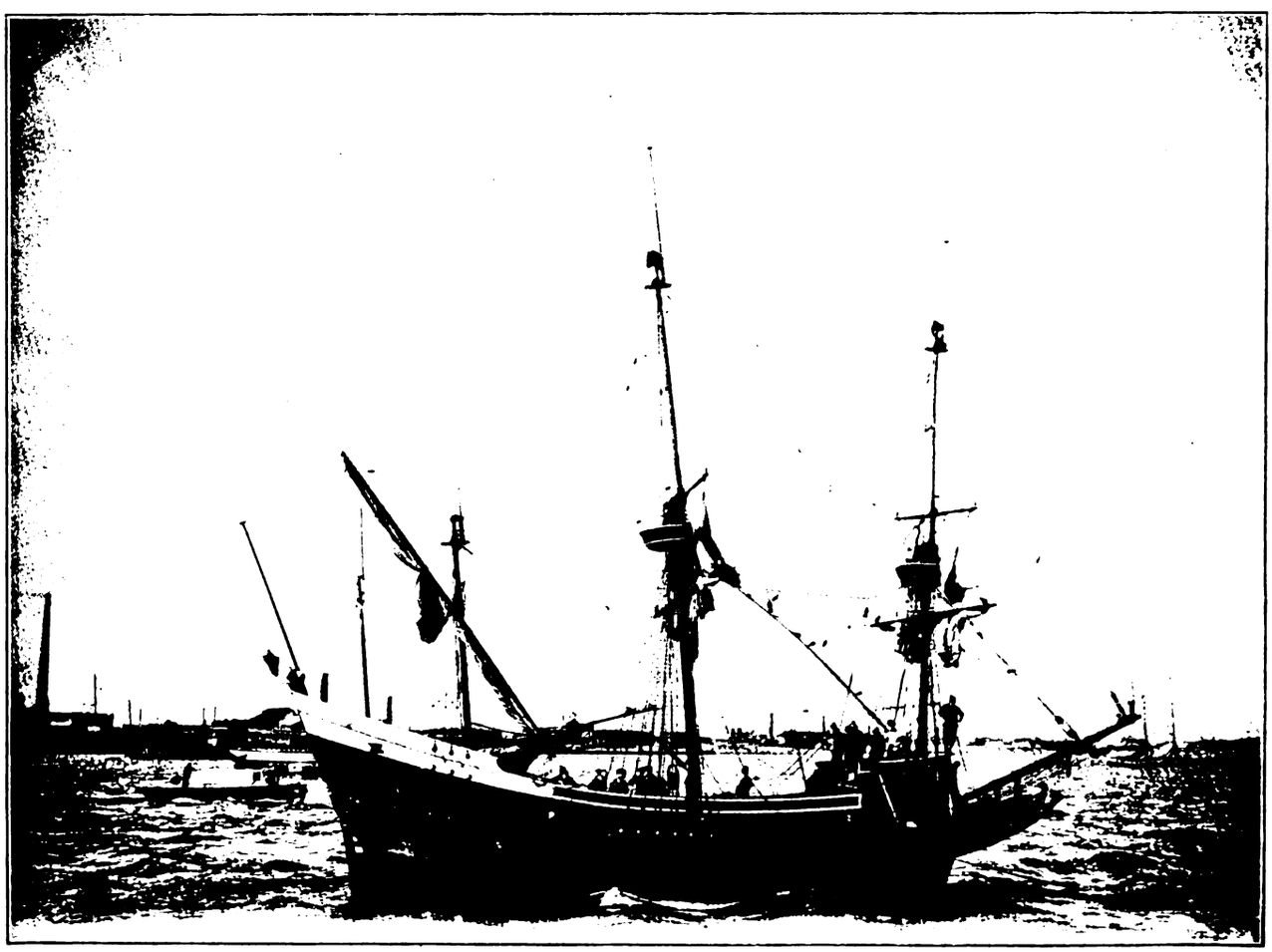
THE scenes displayed in New York harbor on Saturday, Sept. 25, the opening day of the Hudson-Fulton celebration, will probably never be forgotten by those who witnessed them. As a marine spectacle it has certainly never been equalled in America, though in purely naval features of course far inferior to the famous jubilee review at Spithead. The Hudson-Fulton occasion, however, was symbolic of peace and commerce, science and the arts, and the national and universal progress, while the latter was, and intended as, a demonstration to all the world of Great Britain's preparedness for war.

The day was without a flaw. The skies were clear and a crisp breeze gave a temperature just cool enough to be enjoyable.

During the forenoon craft of every sort and description were making their way down the bay. Big stately passenger steamers, coasters, ferryboats, yachts, tugs and lighters; anything with motive power and on which a foothold could be had, and many another besides, contributed to form such a mass of shipping off Staten Island and Bay Ridge as had never before been witnessed in New York harbor. Not a craft there but had its passenger list. The steamboat inspection laws went by the board with a crash but nobody cared. All the inspectors in the service could not have created even an impression. What have steamboat inspection rules to do with such an occasion?

When the Half Moon first breasted the river, Hudson had never heard of steam, and when Fulton and his Clermont made their trial trip inspectors and rules were alike unborn. The only casualties reported resulted from the ramming of a ferryboat by one of Uncle Sam's own revenue cutters.

The scene was set on Friday, Sept. 24, when the long line of naval ships, representatives of the United States, Great Britain, France, Germany, Holland, Italy, Argentine and Mexico anchored in the North river, with the Mayflower at the lower end at Forty-seventh street and the Birmingham at the upper end at 222nd street, almost at Yonkers. The line was eight miles long and included, in addition, the Salem, New York, Montana, Georgia, New Jersey, Nebraska, Rhode Island, Virginia, Wisconsin, Missouri, Kentucky, Connecticut, Vermont, Kansas, Louisiana, Minnesota, Ohio, New Hampshire, Mississippi and Idaho, of the United States navy; the Inflexible, Duke of Edinburgh, Drake and Argyll, of the British navy; Liberté, Justice and Verité, French; Dres-



THE HALF MOON.

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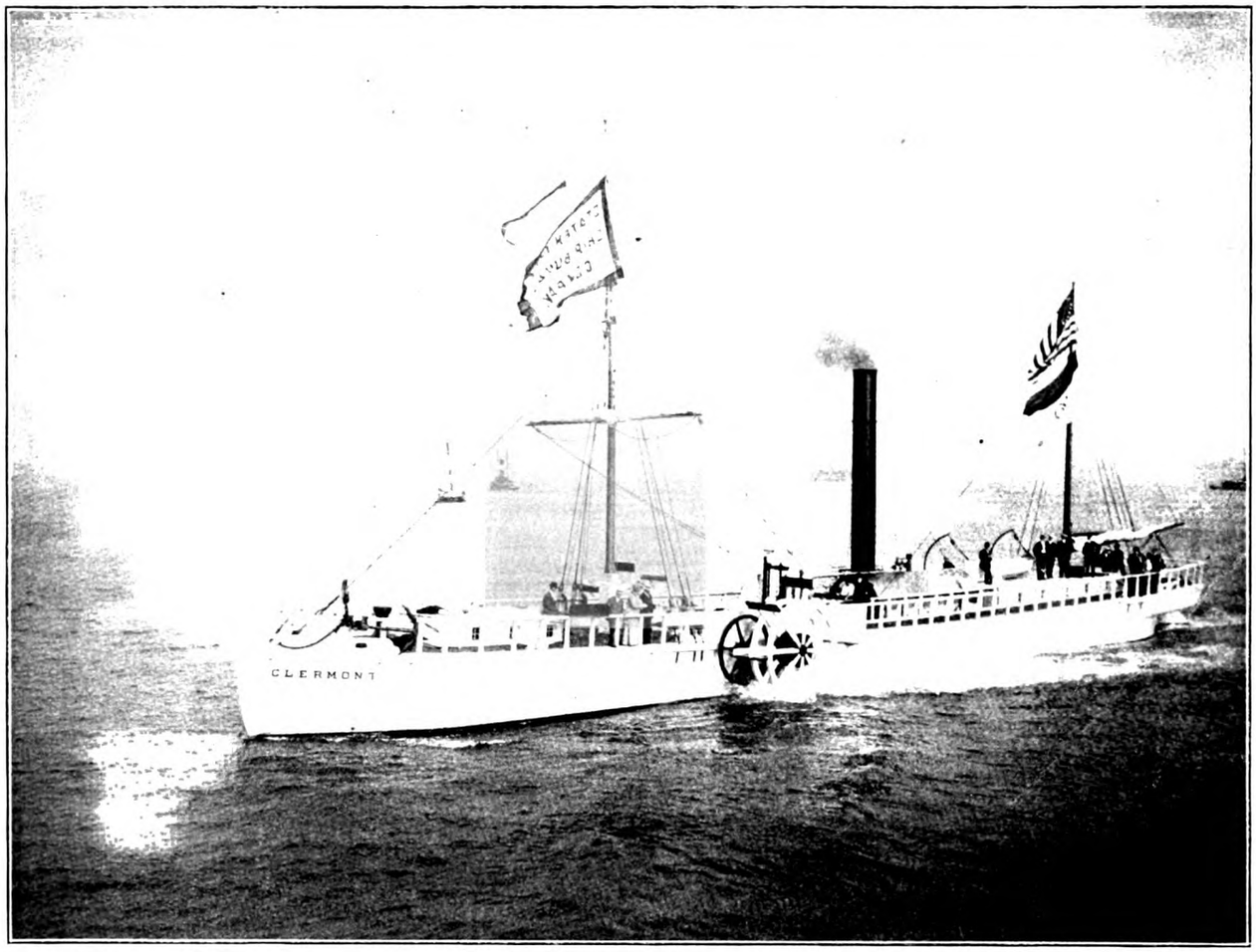
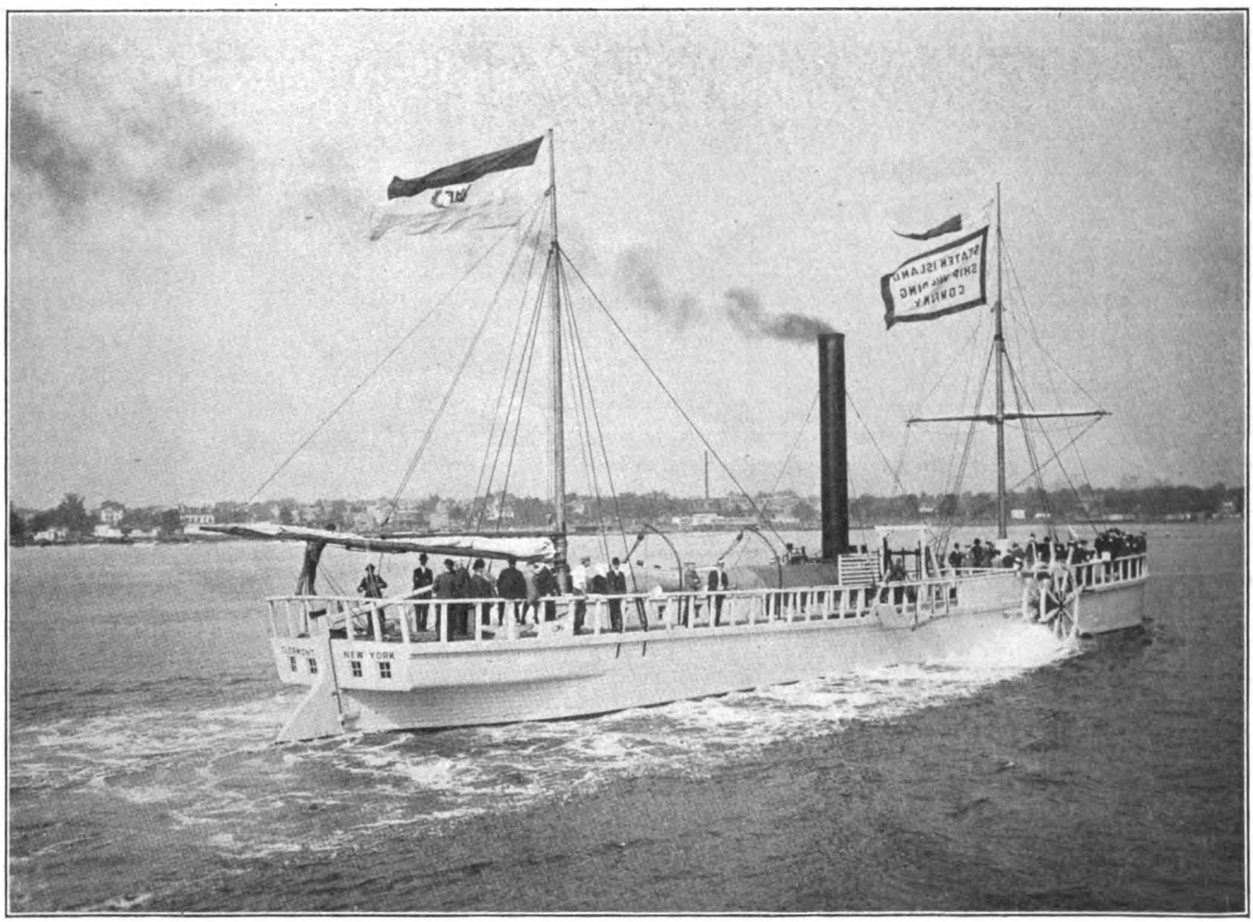


THE CLERMONT UNDER WAY—FORWARD QUARTER



THE CLERMONT UNDER WAY—AFTER QUARTER.

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den, Bremen, Hertha and Victoria Louise, German; Etna and Etruria, Italian; Morales, Mexico; Utrecht, Holland; and Sarmiento, Argentina. With Saturday morning every ship in the line broke out masses and strings of bunting with the signal gun at 8 o'clock. Every craft in the harbor, every pier head and every building ashore were masses of color.

The parade was under the command of Capt. Jacob W. Miller, with the Gloucester as flagship. Promptly at the hour set, 1 p. m., a gun from the Gloucester set the marine cavalcade in motion.

The column was headed by a squadron of revenue cutters, followed by eight torpedo boats; the Gloucester, Aileen and Wasp, with four submarines, the Tarantula, Cuttlefish, Octopus and Viper lumbering and splashing in their wake.

The Half Moon and the Clermont brought up the rear of this column, the former in tow of a tug, with her entire crew, picked from the Dutch cruiser Utrecht, and costumed in the red blouses and wide trousers of Hudson's time, on deck and in the rigging, and the latter sputtering along under her own steam at the dizzy speed of four miles per hour with her little stovepipe of a stack spouting pungent wood smoke and her unhoused paddles splashing brine aboard. The escort squadrons and the "resurrectos" came to anchor off the reviewing stand at the water gate at 110th street, where Hendrick Hudson (Lieut. Lam, of the Royal Dutch navy) went ashore and was received in state by Governor Hughes, Mayor McClellan and Gen. Stewart L. Woodford. Robert Fulton was represented in the persons of several of his descendants. On behalf of the Netherlands, Mr. Van Eeghen formally presented the Half Moon to the Hudson-Fulton commission.

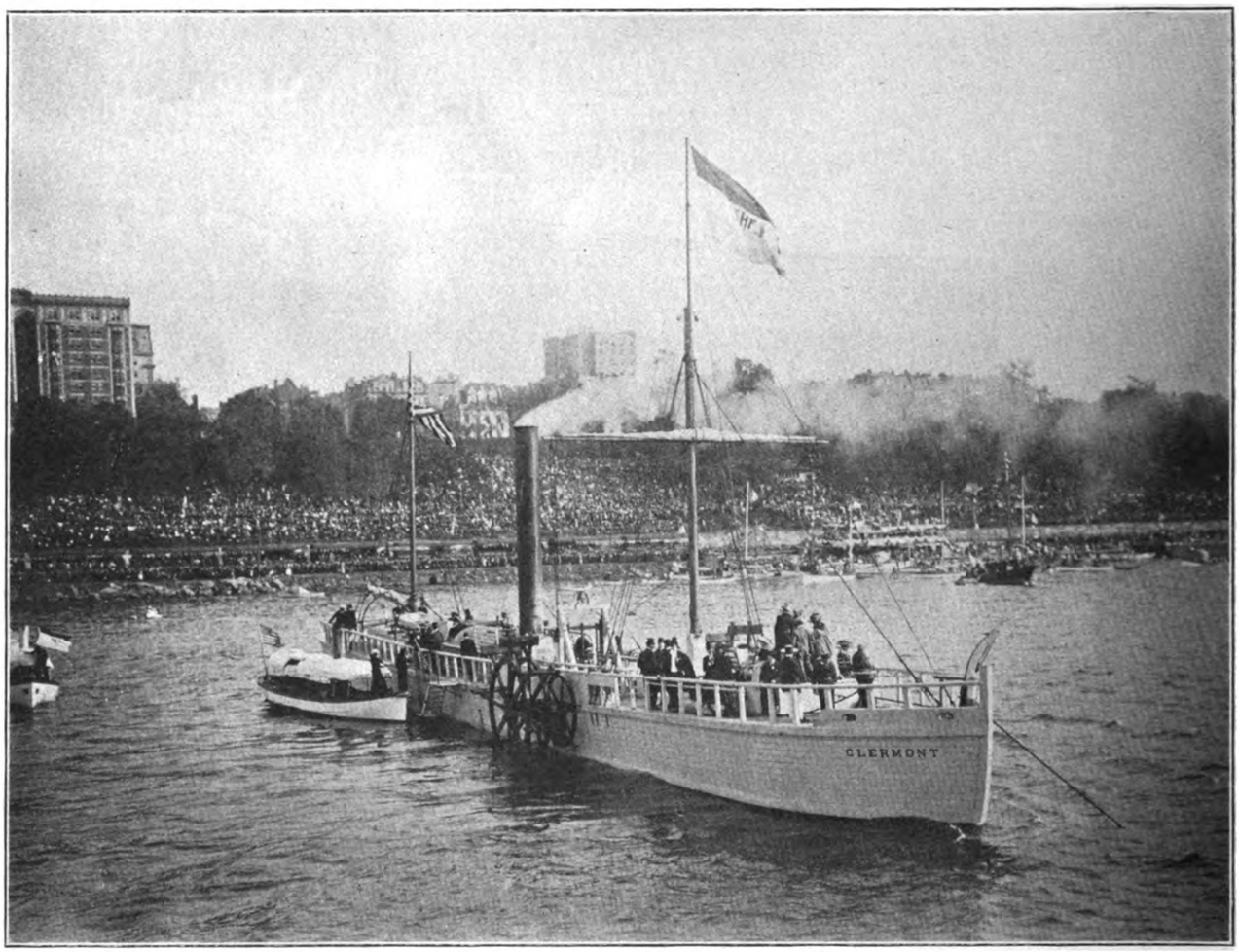
Meanwhile the parade fleet, headed by the Providence, of the Fall River line, taking the westerly side of the naval line proceeded up the river to the turn at 222nd street.

Every boat in the line was crowded with sightseers but the handling was decidedly inferior and the procession straggled wretchedly, prolonging the passage until long after dark. In the van, close behind the Providence, came the old Norwich, nestor of steamboats, followed closely by the Hendrick Hudson and Robert Fulton, examples of latter-day river boats.

Altogether the number of craft taking part in the parade was variously estimated at from 600 to 1,000, while hundreds of others were in evidence which did not join in the procession.

From the signal gun which broke out colors at 8 o'clock, onward until the upper end of the line was rounded by the first divisions, the air was split by continuous salutes from the ships of war. Crews were paraded, bands played, the sightseers cheered, and all went well.

That there were not numerous mishaps with such a mighty throng of craft of all sorts crowding the bay and river from shore to shore is really wonderful.



THE CLERMONT AT ANCHOR AT THE WATER GATE, 110TH STREET.

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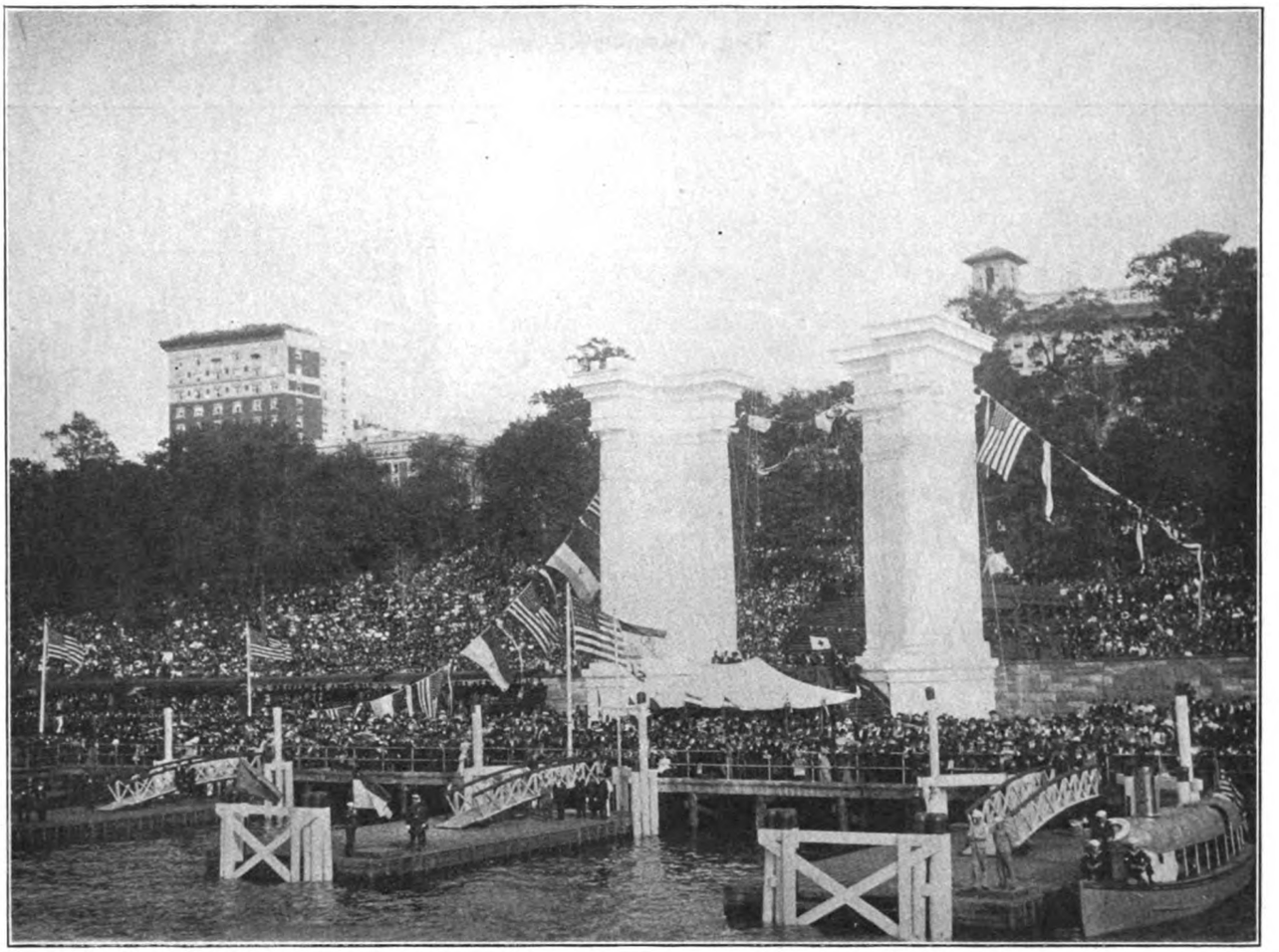
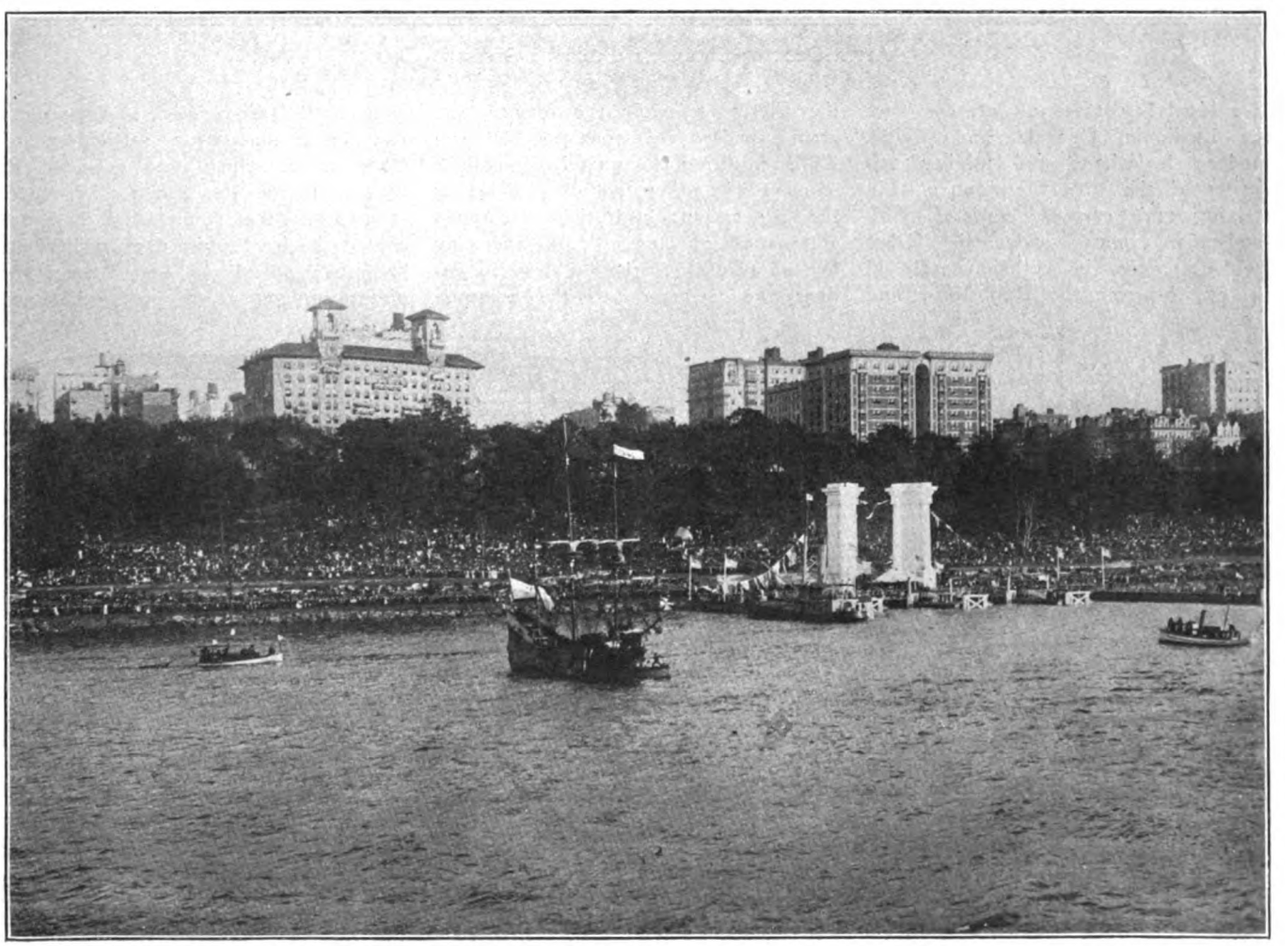


The "Water Gate" and Reviewing Stand, 110th Street.



The Half Moon at Anchor at the Water Gate, 110th Street.

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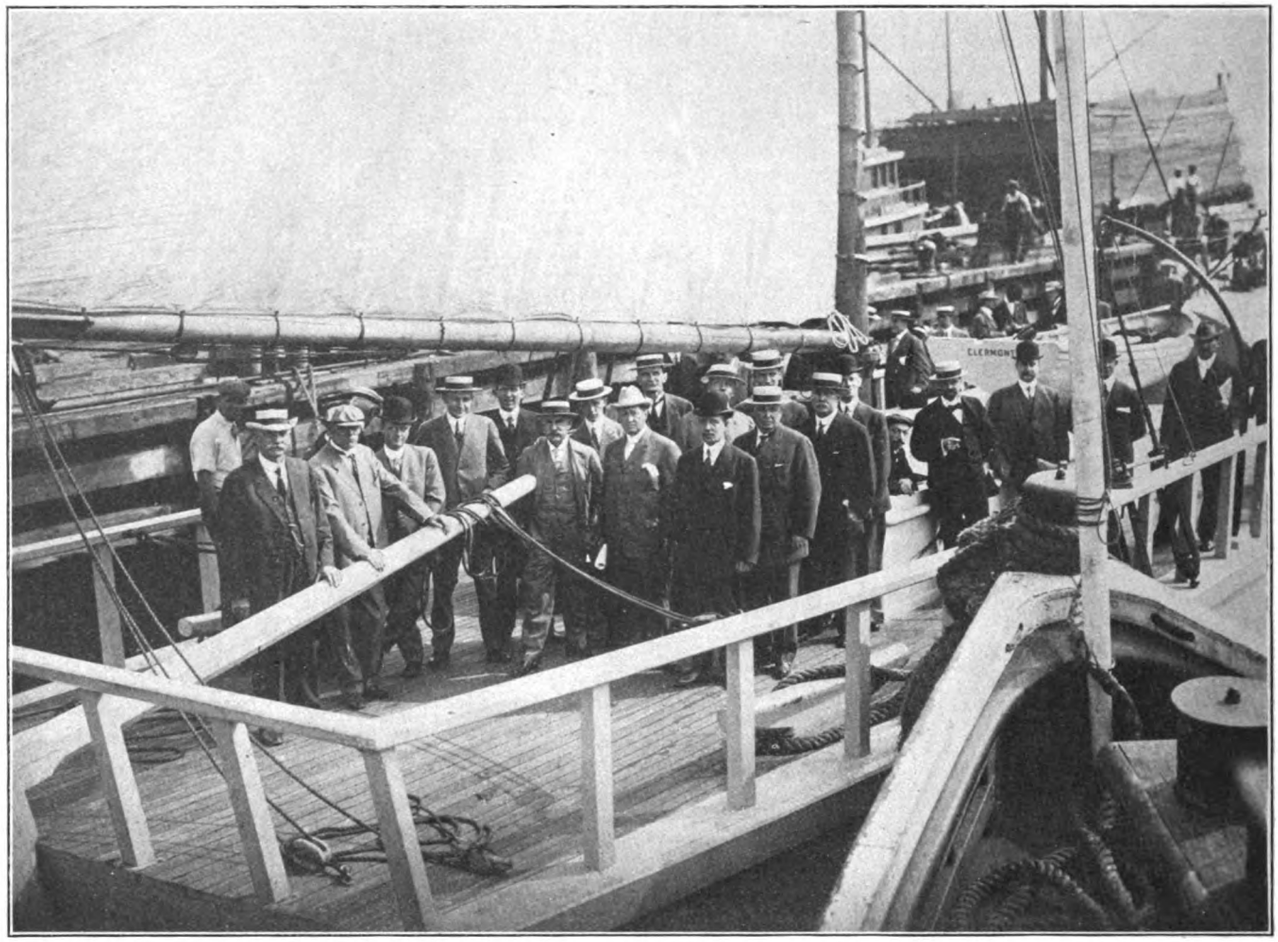
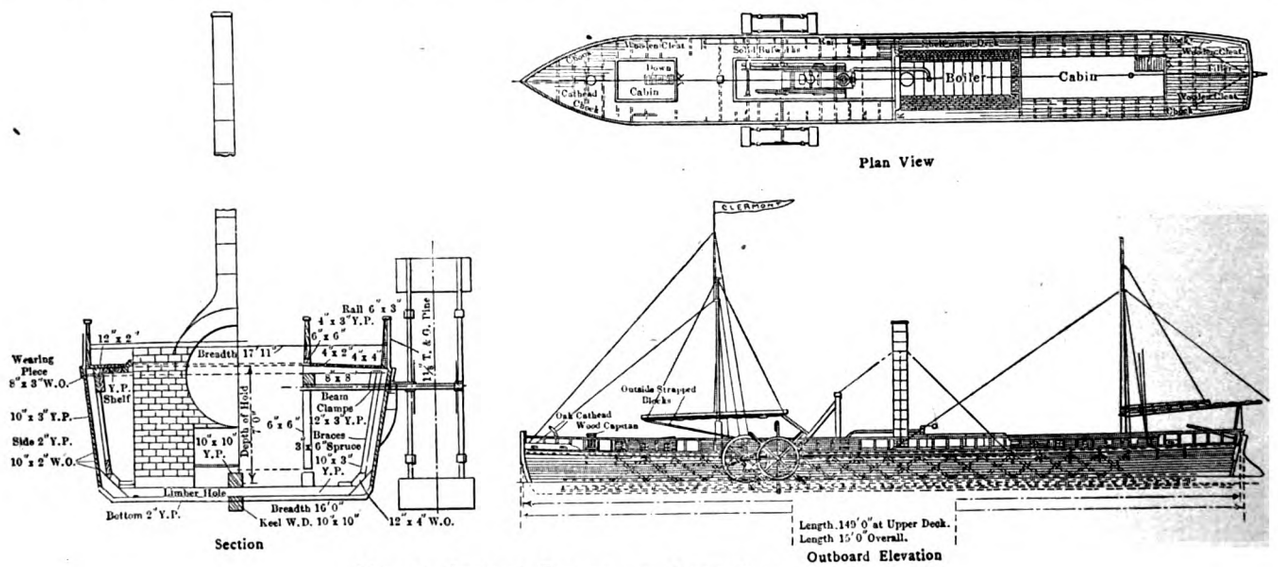


AFTER DECK OF CLERMONT, SHOWING STEERING GEAR.

Incidental features of interest were the Lusitania, Oceanic and Celtic, modern leviathans and mighty offspring of the tiny Clermont and in striking and curious contrast with Hudson's crazy cockleshell. Other incidents were the collision early in the day between the Half Moon and the Clermont, while the former was getting under way from the Kill von Kull, resulting fortunately in slight damage to either and not delaying the procession; and the threatened elimination of Hamlet from the play by the refusal of the builders to deliver the Clermont to the commission until satisfactory arrangements had been made for settlement of their claim, which was adjusted in time to permit the drama to proceed. It appears the commission had accepted the boat some days earlier but had overlooked a very necessary point, customary on such occasions,



MIDSHIP SECTION, PROFILE AND DECK PLAN OF CLERMONT.

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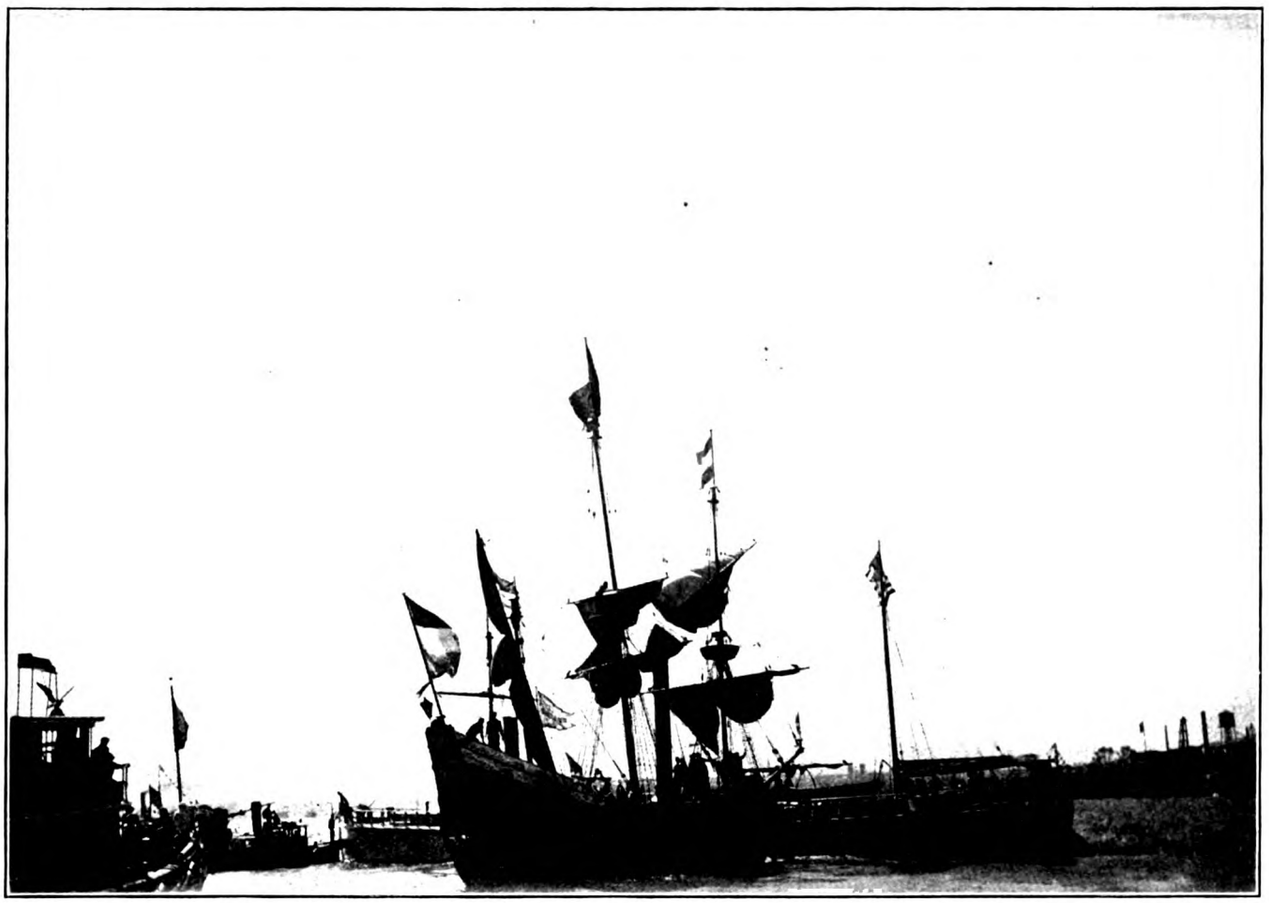
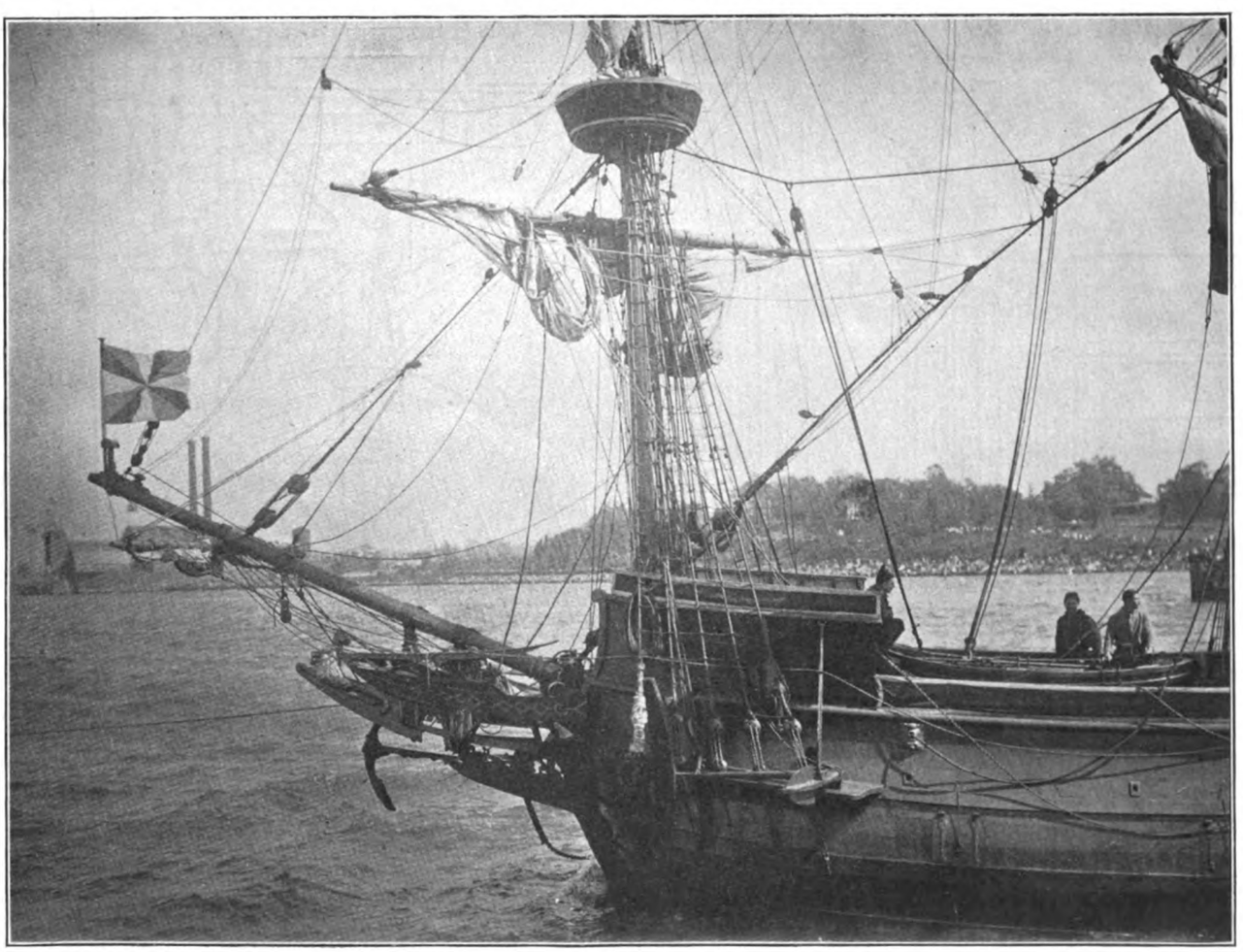


Half Moon and Clermont in Collision.



Forward Rigging and Ground Tackle of Half Moon.

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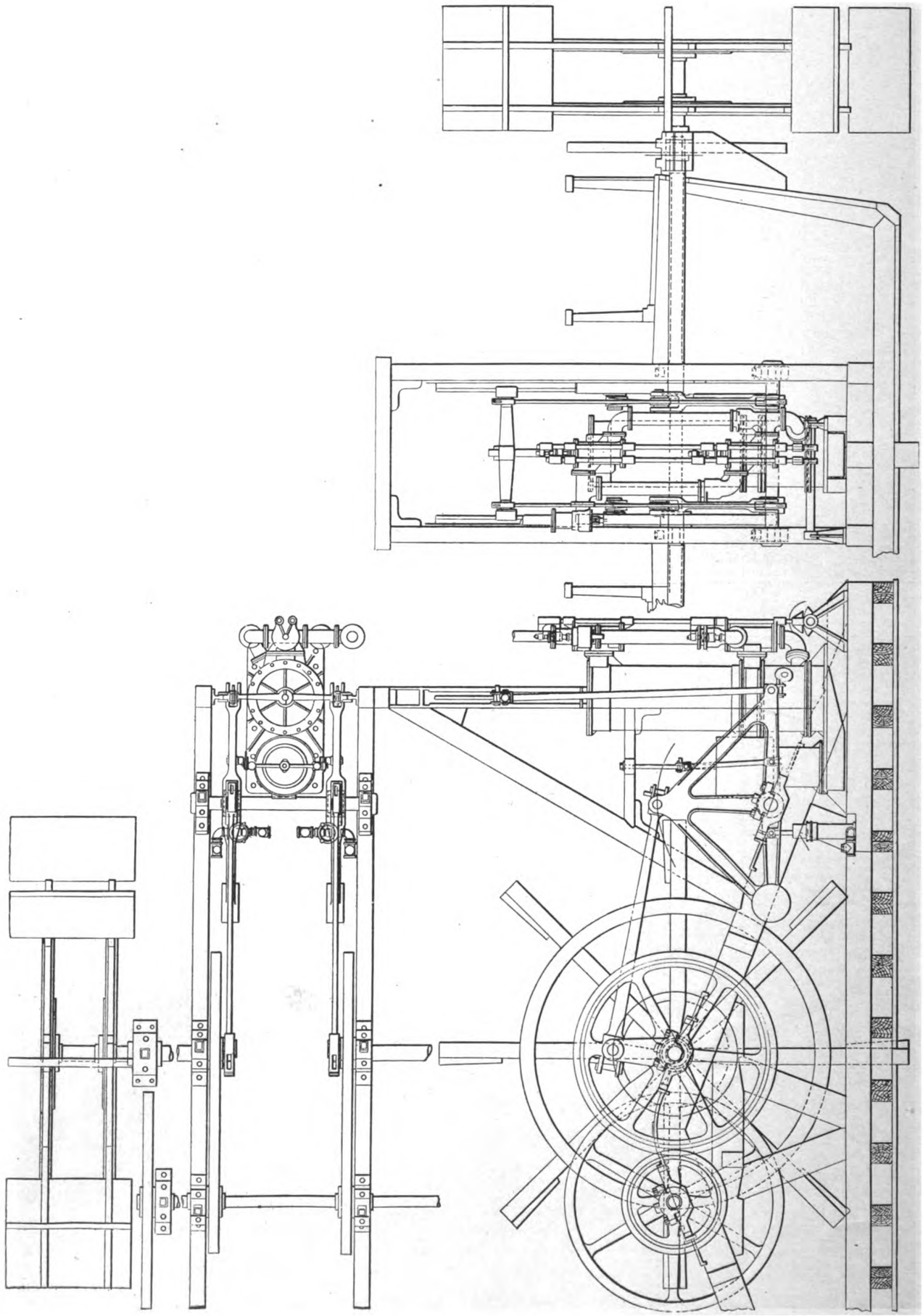

PLAN AND ELEVATIONS OF ENGINES OF CLERMONT.

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and essential in the payment of material and labor claims.

Beyond all doubt one of the most impressive features of the parade was the immensity of the crowd of spectators. From the Battery to Yonkers, a distance of about 12 miles, scarcely a foot of ground or roof space affording a view of the river, especially on the Manhattan side, was unoccupied. Along Riverside Park, from Seventy-second street northward, the bank, drives, roofs, windows, even trees, were packed solidly, as may be seen in the three views of the vicinity of the water gate at 110th street. New York never saw its like before and it may be long before it sees its equal.

Clermont.

The general design and construction of the Clermont and her machinery are sufficiently apparent from the accompanying plans and photos. From reliable existing data the Clermont's dimensions were: Length, 150 ft.; beam on deck, 13 ft.; depth, 7 ft. As for model she may be said to have had none, being practically a parallelogram in plan with the ends pointed to 60 degrees. Her draught was 2 ft.

The original engines were built in England by Boulton & Watt, the new ones, as well as the hull, by the Staten Island Shipbuilding Co. The single cylinder is 24 and 48 in. and designed to work with 20 lbs. steam.

The paddle wheels are 15 ft. outside diameter, with eight buckets 2 ft. x 4 ft.

The boiler is 5 ft. 6 in. diameter, 16 ft. long, set in brick work and arranged for wood fuel.

The Half-Moon is 74.5 ft. long over all, between perpendiculars 58.7 ft., beam 16.9 ft., depth 10 ft., draught 7 ft. The thought must have occurred to everyone who saw her that those who went to sea on her were a venturesome lot and that those who had the daring to cross the Atlantic in her possessed a courage nothing short of reckless.

THE BALLIN SECTIONAL WATER TUBE BOILER.

The present prejudice existing in the minds of steamboat men against small tube and pipe boilers has its foundation in the many shortcomings found to a greater or less degree in most steam generators of this kind.

The reason for the preference given today to water tube boilers of the horizontal tube type is that in these boilers the individual tubes may be inspected, cleaned and repaired without disturbing others, while so far this has not been possible in a practical sense with any of the small tube or pipe boilers. While the large horizontal tube boilers are capable of furnishing high pressure steam quicker and on somewhat less weight than the cylindrical or Scotch boiler, they save little in space and add considerable in cost and attention.

Small tube boilers of the Thornycroft and Yarrow type, while efficient, light and safe, have not found much favor for commercial vessels for the reason that the repair or replacement of tubes beyond the outer rows is impossible or difficult.

Pipe boilers have been chosen principally upon their first cost. They are mostly built up from ordinary steam pipes with screwed fittings which have proven a continual source of trouble and expense. Cleaning the inside of the pipe is impossible and is not attempted at any time. In practically all these boilers the separation of steam and water takes place in the steam drum, into which the full contents of the tubes have to be discharged and where various kinds of more or less efficient contrivances are provided in the shape of baffles, dry pipes, etc., to separate the water and steam.

With these facts in mind, it occurred to Fred A. Ballin, naval architect and engineer, Portland, Oregon, that a design might be worked out in which it would not be necessary to circulate the mixture of steam and water into the steam drum, but which would confine the circulation to each section and effect a separation by elementary forces in the individual sections. The outcome of Mr. Ballin's efforts in this direction is the Ballin Sectional Water Tube Boiler. This boiler, which is the result of over twenty years' experience and ex-

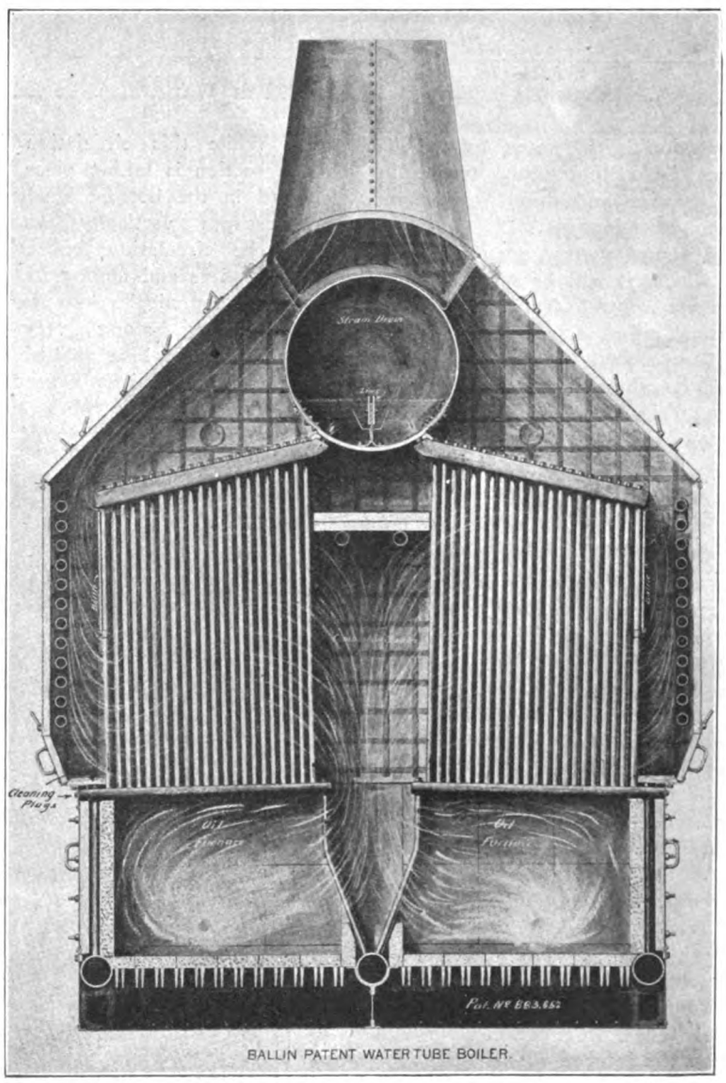

FIG. 1—CROSS SECTION OF THE BALLIN WATER-TUBE BOILER.

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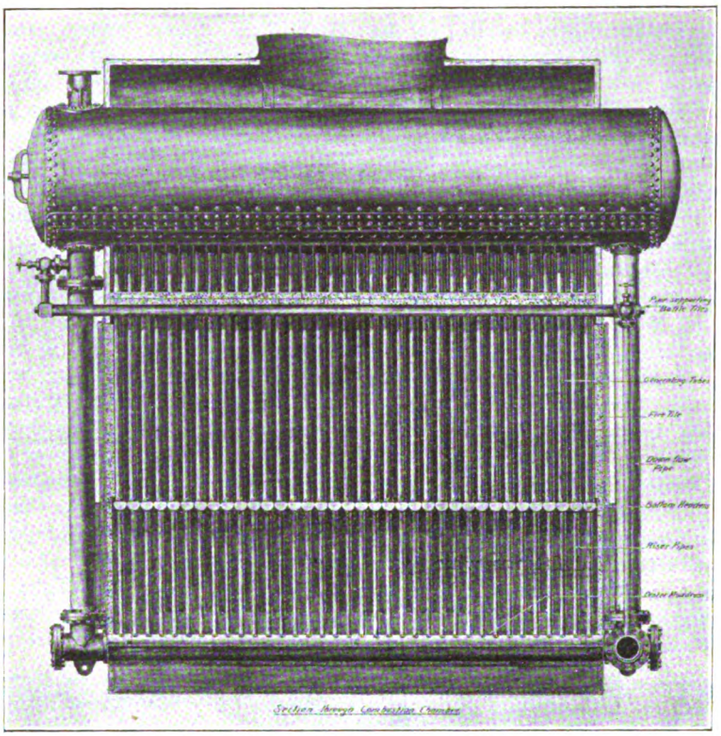

FIG. 2—LONGITUDINAL SECTION OF THE BALLIN WATER-TUBE BOILER.

perimentation with water tube boilers, has been thoroughly tested in actual service and has proven its claim to consideration.

Fig. 1 shows a cross section of the boiler, which, it will be seen, consists of a lower central drum, two banks of vertical tubes arranged on either side of a central combustion chamber and a cylindrical steam drum at the top. The lower central drum is connected to the pipe sections by slightly bent vertical feeder pipes. Each top header is connected to the steam drum by a short nipple. Each section is complete in itself.

As steam will naturally rise vertically, vertical tubes will offer the least impediment to its escape as soon as it is generated. It will be noted that in the Ballin boiler the feed or riser pipes from the lower center drum and the tubes immediately above them, will receive the impact of the hottest gases. An upward current is immediately set up in these generating tubes next to the combustion chamber. As the nipple or steam outlet from the section to the steam drum is not large enough to let this current pass freely, the water thus set in motion is deflected in the top headers away from the steam drum and returns to the bottom header through the generating tubes further removed from the combustion chamber. Tests have shown that when such circulation is once set up it will remain constant. While this circulation inside of each section is taking place, steam generated in the bottom headers and tubes escapes vertically with and against the circulation, collecting in the top headers and finding its escape through the top nipples into the steam drum, carrying along very little water. The great heat applied to the inside bent riser pipes causes them to act as generating tubes and induces a very strong upflow of water, more than can be evaporated by the whole section. The surplus water thus entering the section is taken care of by the tube connecting the section to the side lower drums, which thus acts as a downflow pipe. The heated water thus returned meets in these downflow pipes the new entering feed water from the heater, causing it to precipitate any impurities it may contain.

It is evident from the above described internal action, which is not a hypothesis but observed by actual demonstration, that each section in itself represents a boiler in miniature, having its feed and downflow pipes and generating tubes, each one independent of its neighbor and each one with a steam connection discharging into the common steam drum only steam with very slight admixture of water. Understanding this action will explain the fact that this boiler gives almost perfectly dry steam even when forced or when the vessel is rolling in heavy seas. Fears were expressed by engineers that the evaporation might leave deposits in the bottom headers, since they are exposed to the hottest direct fire. To guard against such possibility, the cross section of these headers is made D shaped and is as small as possible. Inspection after five months continuous steaming has proved them to be perfectly clean and without a vestige of deposit. This shows that the circulation in the headers is almost perfect. The sections are so arranged that they can be withdrawn from the top through openings left in the casing

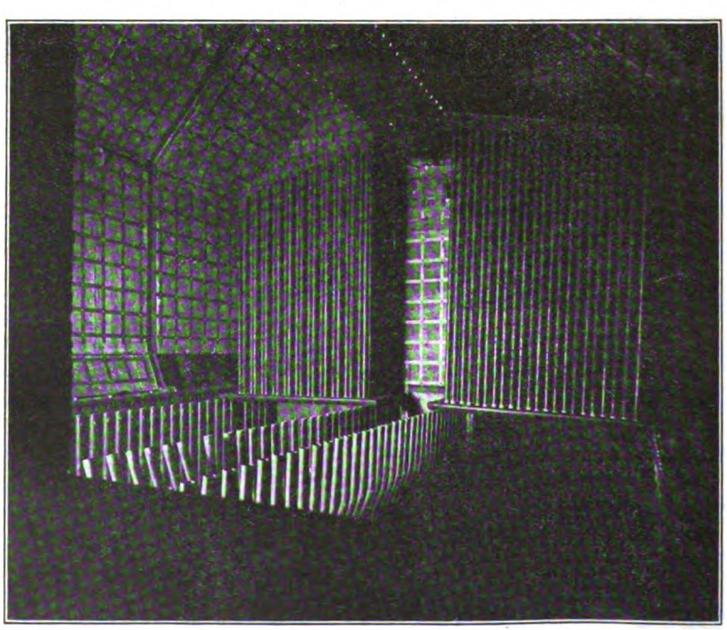

FIG. 3—INTERIOR VIEW THROUGH THE FLUE DOOR, SHOWING SOME OF THE SECTIONS IN PLACE.

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for that purpose, for which, in most ships, space can be made available.

As arranged, the sections surround the combustion chamber, which is omitted in practically all water tube boilers, but is as necessary to proper economy in a boiler of this type as in a Scotch boiler, since it promotes combustion before the gases pass between the generating tubes; otherwise sooting and clogging is inevitable. This combustion chamber being common to both furnaces, has the additional advantage of preventing cold air from entering between the generating tubes while firing, as such air, flowing in through the furnace doors, must meet the flame from the opposite furnace.

The Ballin boiler possesses the following features which the designer believes will recommend it to engineers: Simplicity of design; accessibility of all parts, particularly the inside and outside of all generating tubes, headers, drums, etc.; interchangeability of all parts subject to renewal; elimination of all ordinary steam pipes and castings of any sort from the generating portion of the boiler; horizontal flow of gases and by proper baffling, the efficient utilization of heat. Any tube or section may be removed without disturbing any adjacent section; the feed water heaters utilize waste gases only, do not interfere with the draft and may be quickly removed or by-passed; the casing is properly insulated against radiation; the boiler is light in weight, durable and sufficiently flexible in design to be adapted to the available space in the ship.

Two of these boilers have been installed in the steamer H. B. Kennedy (See THE MARINE REVIEW, April, 1909), and have now been in commission a sufficient length of time to prove their success.

These boilers each have 4,000 sq. ft. of heating surface and are fitted for oil fuel, one burner being placed in each end of the furnace. They work with natural draft, furnishing dry steam for a 4-cylinder triple expansion engine, developing up to 2,400 H. P.

The available space in this steamer was limited, as the owners desired all possible deck room for passengers. Smoking rooms were placed on each side of the boiler hatch, the boilers themselves being left exposed. As the gases in the uptake by test showed only about 500° Fahr., very little heat radiates into these rooms. Each boiler occupies a floor space of 10 ft. by 10 ft. and is about 14 ft. in height to the top of the casing. They weigh complete 48,000 lb. or 12 lb. per sq. ft. of heating surface.

All the small tubes are seamless drawn, 1½ in. outside diameter. They are expanded into the top headers and can be inspected, cleaned and withdrawn through corresponding holes in the top of the headers, which holes are closed by double-taper plugs.

The riser pipes, as may be seen, are also easily accessible; they are expanded into the lower headers. These latter can be inspected and cleaned through plugs projecting through the outside of the casing.

The top and bottom headers are rolled to their respective shapes from heavy seamless drawn tubing. Each section is tested to 800 lb. hydrostatic pressure.

In order to withdraw a complete section it is only necessary to cut the two lower pipes and the nipple connecting the section to the steam drum. These pipes and nipples, if kept on hand, can be easily replaced. Several spare sections are carried on board, and as particular pains are taken to make every section interchangeable, new sections may be quickly installed.

To facilitate cleaning and repairs the doors and shutters of the casing are provided with quick opening dogs and latches, and wherever repairs might have to be made the casing is provided with removable sections.

The Willamette Iron & Steel Works, Portland, are the builders of these boilers on the Pacific coast. The designer and patentee of the boiler is Fred A. Ballin, 43½ Second street, Portland, Oregon.

CAPE COD CANAL.

Fine progress is being made upon the ship canal which is to be built across Cape Cod, Mass., to connect Buzzards Bay with Barnstable Bay, which was begun with appropriate public ceremonies on June 22.

Excavation for the canal will be almost entirely through sandy soil containing gravel and some boulders, although it is anticipated that there will be but few of the latter which will require blasting. The cut will have a depth throughout of 25 ft. at mean low water, and a bottom width of 100 ft., with side slopes of 1 on 2 up to bermes 6 ft. wide, above which the same slope extends to the surface of the ground. There will be three nearly equi-distant turning basin where, for a length of 800 ft., the bottom width will be increased to 200 ft.

Electric lights are to be provided throughout the length of the canal and the illumination is to be carried out about six miles beyond the western shore end by lighted buoys anchored on both sides of the approach channel. This channel will be dredged to a depth of 26 ft. and will have a bottom width of 250 ft. with side slopes of 1 on 3.

The length of the canal will be approximately 8 miles between shore lines and it will effect a saving of 66 miles of the 326 miles on the present route through Vineyard Bay, or of 142 miles of the 402-mile present outside route, between New York and Boston. Corresponding reductions will be effected in the routes from Baltimore and other southerly ports to Boston and Portland. Not the least of the advantages of the canal will be the added safety gained by avoiding the numerous and dangerous shoals and the prevailing fogs in Vineyard Sound. The canal will not only effect a great saving in time and distance as well as permit of increased speeds, but it will also reduce costly insurance by a goodly percentage.

It is estimated that 6,000 steam vessels and 24,000 sailing vessels with average tonnage registers of 1,500 and 600 tons respectively, making a total of over 23,000,000 tons register, annually pass the Handkerchief Shoals light, going around Cape Cod, for much of which the canal will become available. This traffic is constantly increasing and a very large percentage of it consists of bulky freight in tows which pass almost exclusively through Vineyard Sound where the fogs often make it necessary for them to stop and wait for periods one or more days in length. When the canal is completed and a deep water channel buoyed and lighted through the shoals it is believed that the traffic can be maintained almost continuously there through very foggy weather.

A navigable canal across Cape Cod has been under projection for at least 250 years and records concerning the undertaking, such as surveys, reports and investigations, extend back to 1670. This canal is therefore one of the oldest enterprises of this nature in the country. In fact several companies have been organized at various times to construct such a cut as is now under way, but only one of them actually commenced operations, later abandoning the project.

The present enterprise is conducted under a charter granted to the Boston, Cape Cod & New York Canal Co., August Belmont, president.

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Shipbuilding of Yesterday and Today

By George Leslie.

(Reprinted from *Cassier's Magazine.*)

In no branch of human effort have greater strides been made during the last three decades or so than in ship construction and design. Thirty years ago iron, which had previously supplanted wood as a shipbuilding medium, and itself brought radical changes, was on the eve of being displaced by the subtler material, mild steel, with its greater tenacity, less comparative weight and wider usefulness.

The completeness of the surrender of iron to steel is forcibly brought home by the fact that the iron to be had so plentifully when the demand was great cannot be bought now. Material there is of the name, but take a sample and compare it with a piece broken from a hull discarded after thirty-five or forty years' useful service. Inspection and mechanical testing alike prove the older material to be superior. It is not, of course, that metallurgists are less ingenious than formerly; but that iron, having served its day and proved a stepping-stone to higher things, no longer claims the attention it did, and consequently tends to fall in quality in keeping with its reduced importance as a constructive element.

Possibilities of Mild Steel.

It is not too much to say that the advance in shipbuilding since the introduction of mild steel has been greatly helped by the possibilities of that material. Particularly has this been so in matters of detail—and ship construction is made up of details. Since every joint in a structure is potentially a point of weakness, and as steel plates can be manufactured longer and wider than iron plates, an early improvement was effected by reducing the number of joints. Then the form of joints was dealt with, overlapped end joints being substituted for those of the less efficient and more expensive butt or flush type. It is only fair to acknowledge that the overlapped end joint, though admitted an improvement in construction, was objected to as unsightly and as increasing the resistance to the motion of the vessel. But by fitting the plates with the exposed ends looking aft, the latter drawback was minimized, and custom has long since reconciled us to the former.

Other modifications of comparatively recent adoption directly traceable to the superior ductile qualities of steel are the joggling of plates at the edge joints, particularly those of the shell; also the scarphing of the end joints for the breadth of the edge laps, thus avoiding the use of packing pieces, saving weight and improving the construction. Then there is the flanging of plates to form right-angled joints and bulkhead stiffness, as against the fitting of angle bars, economical improvements clearly, though opposed by some builders on the ground that the loss of stiffness due to the omission of the rolled bar is not made good by merely deepening the web slightly, as is usually done.

Structural Ballast Tanks.

The introduction of structural ballast tanks is to be included in the chronicle of progress, although it is something of an old story now. The first ballast tank was, of course, a rather crude affair. First steps are usually tentative, and this was no exception to the rule. We have no intention, nor is this the place, to describe the schemes proposed and adopted from time to time for the conveyance of water ballast; but a comparison of the earliest water ballast tank with the latest affords no bad illustration of the skill and ingenuity which have been brought to bear upon ship construction in modern times.

The writer has vivid recollections of the first vessel built with an inner bottom having the frames cut at the bilge which came under his notice. This is a story of twenty-five years ago, and tanks so built were very few. It was the first attempt of the firm concerned. Well, the manager and foremen carefully considered the matter, and concluded that the only way under the circumstances to keep the hull fair was to erect the frames complete from keel to gunwale, fair the body, and, after carefully shoring and ribbanding and taking special precautions to prevent movement at the parts affected, to cut the frames on the stocks. This was done, and the job was, of course, a splendid one; but the cost was considerable. Contrast this with the modern method of construction, in which the framing is done piecemeal and the inner bottom is framed and even plated before the structure above the bilge is started with. Everyone frequenting a shipyard is familiar with the long, skatelike body of the completely framed ballast tank and inner bottom, which, as it lies on the stocks, looks like anything other than a ship.

Doubling the Vessel's Size.

Important departures in ship evolution have also been due to the demands of commerce and the continual striving for economy forced on owners by the keenness of modern competition. It was quickly seen that doubling the size of a steamer need mean little increase of crew or working expenses, and so large vessels became the order of the day. Again, the demands of owners for improved stowage facilities, and for vessels suitable for special trades, led to the suppresion of lower decks, tiers of beams and ranges of pillars—modifications, now that they are accomplished, which seem simple enough, but which called for the exercise of much skill and scientific ability, since the standard of structural strength had to be preserved. All this should be borne in mind when reckoning up the progress of the years.

Turning to design, we find developments no less remarkable. In general appearance sea-craft are much changed—it must be admitted, in some respects not for the better. Cargo steamers, particularly, have degenerated in outward form. They are clumsier, more angular, less graceful, than formerly. One looks in vain in our waterways for the clipper bows, rakish masts and trim sails of the early traders. The changes which culminated in the "tramp" of to-day came gradually. First the masts, already reduced in number, size and importance by the supersession of steam over sail power, were stripped of yards and square sails, and later of trysails, in some steamers not even a staysail being carried. Now, alas for sentiment! masts are frequently fitted without rake; and gawky a ship so fitted looks alongside those of the older style. But a raked mast is a bad derrick post, and efficiency first, appearance last, is the present rule.

Changes in Appearance.

Even standing rigging, with its convenient rattlins, beloved of the youthful mariner, is disappearing in favor of the widely-spaced guy ropes, a prosaic iron ladder riveted to the mast, giving access to the masthead.

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In many vessels, too, forests of derrick posts stand up awkwardly from the deck, making, with derricks and running gear, when seen on the skyline, a most extraordinary show, the ships looking for all the world like floating factories.

But why detail the degeneracy? It is the new cult in shipbuilding, and, whatever we may think, has come to stay. Outward appearance apart, however, change of design has always been in the direction of simplification of parts, perfection of detail and general improvement. Thus the standard of comfort has been raised. Forecastles are not the pokey holes they once were. The limit of deck space per man is greater, the 'tween decks loftier, and light and ventilation improved. Officers, too, are seldom now accommodated in the bridge 'tween decks, with its close atmosphere and passages smelling of the engine room, but are housed on the upper bridge, in roomy central apartments, airy, dry and convenient to the deck. Railed gangways now span the dangerous wells; bulwarks have been raised and strengthened. The vulnerable machinery openings are protected with substantial casings, and bridge fronts are strong enough to defy the wildest seas.

Designed on Scientific Lines.

Moreover, the modern steamer is designed on scientific lines, which could not be said of its early prototype. Thirty years ago there was little science and much rule of thumb practiced in the designing offices of the shipyards. Not unfrequently the model was made to please the eye and the lines plan afterwards drawn from it. No one can defend this practice, although the graceful forms of the clippers of that day were thus evolved.

Before the Daphne disaster few private firms went the length of making stability investigation. What were metacenters and centers of gravity? Vessels had been built since the Ark with little regard to such matters, and could still be built; so the clipper experts reasoned. Then came the Daphne accident and changed all this. Stability became everything. The technical papers were full of it, the scientific societies were full of it; budding naval architects spoke of little else.

In this connection, the writer recalls a little incident which came within his personal knowledge, and shows the spirit of the times. In a certain yard a vessel was about to be launched. The firm was old, and had many launches to its credit; but the general manager was troubled. What if she should upset? Two such Clyde disasters were unthinkable. The chief draughtsman was summoned and the position explained to him. At the time the draughtsman knew nothing of the vessel's condition; but an hour later informed his chief, to that gentleman's great relief, that the vessel was safe. How was it done, since this is no age of miracles? Simply enough. He assumed a position of center of gravity. One is reminded of the mariner who securely moored his ship to a buoy, then went to sleep, and woke up to find his vessel on the rocks.

Trend of Ship Building Practice.

Things are different now. Every respectable establishment has its reliable expert. Vessels are designed on paper and their qualities ascertained before a hammer is lifted in the yard towards their construction. The number of calculations made for a single ship is truly astonishing. Estimates of displacement and dead weight, also of strength, stability and trim under service conditions, and countless calculations of a minor character, are the usual routine of an office.

A master stepping on a new ship is not now entirely ignorant of her sea-qualities. Frequently he is supplied with information which, used intelligently at the outset of a voyage, may save him much anxiety.

On the whole, it appears from this brief review that the trend of modern shipbuilding practice is in the right direction, that there is a healthy tendency to change—to try things—which bodes well for the future of the industry, Developments along the line of economical construction may thus be expected, while vessels of new characteristics will crop up from time to time as circumstances demand them. What the ultimate type, even of the cargo boat, will be it is impossible definitely to predict. If the advance of the last quarter century be maintained, however, the probability is she will be of gigantic proportions and of little outward beauty; but safer, more comfortable, and a better investment for money than anything that has gone before.

The 22-ton compound engines built for the new tug, George L. Potter, at the ship yard of the Skinner Ship Building & Drydock Co. at Baltimore were hoisted on board on Sept. 22.

LLOYDS REGISTER SHIP BUILDING RETURNS.

From the returns compiled by Lloyds Register of Shipping, it appears that exclusive of warships there were 308 vessels of 745,705 gross tons under construction in the United Kingdom at the close of the quarter ended June 30, 1909. Of this number 275 were steam vessels with a combined gross tonnage of 739,991, and 35 were sailing vessels with a total of 5,714 gross tons, as against 349 steam vessels, of 794,005 gross tons, and 37 sailing vessels, of 5,173 gross tons, for the same period of 1908.

The tonnage now under construction is therefore about 166,000 tons less than that which was in hand at the end of the last quarter and about 53,000 tons less than that building 12 months ago.

Of the vessels under construction in the United Kingdom at the end of June, 217, of 435,416 gross tons, are under supervision of the surveyors of Lloyds Register with a view to classification by the society. In addition 61 vessels, of 162,066 tons, are building abroad with a view to classification by Lloyds. Thus the total of construction at the present time under the supervision of Lloyds Register is 278 vessels, of 597,482 gross tons.

The Belfast district is shown to be in the lead in point of tonnage under construction, having 23 vessels, of 203,491 gross tons to its credit, while the Glasgow district leads in the number of vessels being built, having 69 hulls, of 139,994 gross tons under way.

There are 70 vessels of over 100 and less than 500 gross tons under way, this being the greatest number in any one class. Of vessels of over 500 and less than 1,000 tons there are 23; of between 1,000 and 2,000 tons, 33; of between 2,000 and 4,000 tons, 63; of between 4,000 and 6,000 tons, 50; of between 6,000 and 8,000 tons, 12; of between 8,000 and 10,000 tons, two; of between 10,000 and 12,000 tons, one; of between 12,000 and 15,000 tons, four. Two vessels are of 20,000 or more gross tons.

Of warship construction in the United Kingdom the returns show 69 vessels, of 223,950 tons displacement in hand. Of this number 12, of 49,600 tons displacement, are building for foreign powers or their ownership has not been designated, the remainder being for the British admiralty.

The returns from the United States are exclusive of the great lakes district and show 41 vessels, of 49,079 gross tons, under construction.

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Ore Handling on the Atlantic Coast

Inauguration of Improved Modern Equipment Displacing Older Methods

THE use of foreign ore in American iron-making dates from 1875, when the first cargo, shipped from Spain, was received at Baltimore.

By 1907 the imports had reached in round figures 1,230,000 tons, falling off for 1908 to 777,000 tons, exclusive of manganese, pyrites, etc. For 1909, the total imports will probably considerably exceed those of 1907, which is the record year. The ports of origin are widely scattered: Poti, in the Black Sea; Seriphos, in the Grecian archipelago; Cartagena, Bilbao and Saguntum, in Spain; Benisaf and Algiers, in Africa; Narvik, in Sweden; Wabana, in Newfoundland, and Santiago and Daiquiri, in Cuba, and practically all is unloaded at Philadelphia and Baltimore. Of the 1908 totals, 583,000 tons came from Cuba, of which the Juragua Iron Co., a subsidiary of the Bethlehem Steel Co., shipped 329,000 tons, and the Spanish-American Iron Co., a subsidiary of the Pennsylvania Steel Co., 254,000 tons. Practically all of the latter came to Baltimore, which received 46 cargoes, of 249,000 tons, while Philadelphia received from Cuba 75 cargoes, of 330,000 tons. Of the remaining 194,000 tons, about 126,000 came from Spain, 48,000 from Newfoundland, and 4,500 from Sweden, and the balance scattered among the various other shipping ports. The importations from Sweden for 1909 will exhibit a striking increase, as it is expected that the amount will reach nearly 200,000 tons, on the basis of shipments up to Aug. 1. Outside of Philadelphia and Baltimore, only 11,000 tons were discharged at all other ports in 1908. The total for Philadelphia was, therefore, about 517,000 tons, of which about 440,000 tons were handled over the Philadelphia & Reading docks and the balance by the Pennsylvania railroad at Girard's Point. At Baltimore the ore is handled by the Pennsylvania railroad at Sparrow's Point.

Points of Destination.

Practically none of this ore finds its way over 100 miles from tidewater, Harrisburg being the westerly limit, where it meets lake ores on even terms.

The average ore train from tidewater cannot handle more than about one-third the weights moved by similar trains from lower lake docks, which is of course a powerful factor. From Philadelphia the Reading railroad distributes to Bethlehem, Swedeland, Pottstown, Catasauqua, Hokendauqua, Hellertown, Donaghmore, Birdsboro, Reading, Emaus and Temple. From Baltimore the Pennsylvania railroad distributes to Harrisburg, Steelton and Lebanon.

The entire ore business is carried on in foreign ships; an American ship is almost never seen in the trade, and of the total tonnage, about 80 per cent is British. The average cargo is about 4,500 tons; the largest reach 6,000 tons, and come chiefly from Spain. This will, however, be modified in time, as the Cuban docks are enlarged and shipping and unloading facilities improved, though one of the Cuban loading docks of the Spanish-American Co. can now handle ships up to about 5,500 tons capacity. This is seen in the average of the Baltimore cargoes, which is, for 1908, 5,400 tons, while the average of the Philadelphia cargoes is 4,400 tons. Two new shipping ports in Cuba are being opened up by the Spanish-American Co.: one called Felton, after the president of the Pennsylvania Steel Co., on Nipe bay, on the northeastern coast, on which work is being actively pushed, and the other named Nimanima, about 9 miles west of Santiago, from which the first cargo of ore, 5,000 tons, reached Baltimore Aug. 7.

FIG. 1—THE TRAMP.

Crude Methods.

The ships employed in the trade are chiefly, in fact almost entirely, of the standard tramp type, seen in Fig. 1, which does not lend itself to rapid work. The unloading appliances with which such wonderful records are made on the docks of the lakes could not be employed with these ships at all. Almost all have laid main decks, with stanchions, and with shaft tunnels in the after holds. The hatches are narrow and the tank tops and floors light and no two ships have hatches alike, either as to size or spacing. For this reason the old one-ton bucket, with shovelers in the hold, has held its own. The dock managers are fully alive to the crudity of the methods employed, but unless the type of ship and the dock rigs can be developed together, as has been the case on the lakes, actual advance must be slow, and this will probably only come about with the building of ships for the ore

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and coal trades exclusively, a condition which will naturally result from the continued growth of the business.

The same method and type of rig is in use on all the docks, and while expensive in labor costs, is simple and cheap, both in first cost and maintenance.

Unloading the Cargo.

As seen in Fig. 2, one of the ship's derrick booms is topped up over the hatch and the fall of the single whip led to a winch. From the head of a mast on the dock a messenger leads to a winch on the dock and the other end, with a wide hook, is taken aboard. As the bucket breasts the hatch coaming, the hooker-on very skilfully casts and hooks in the end of his messenger, and at the same instant the winch ashore takes all slack and sways the bucket over the side and above the car, where it is tripped by a man stationed for the purpose. Fig. 2 shows a bucket just clearing the hatch and the messenger hooked in, and in Fig. 3 can be seen the bucket swayed out over the car. At this point, as can be seen, when the ship is nearly worked out, the winch on board must slack out somewhat to bring the bucket within reach of the tripper.

In addition to the shovelers in the hold, there are required five men for each hatch; two winch men, one signal man, one hooker-on and one tripper. The signal man is made necessary by the fact that neither winch man can see the bucket below the hatch coaming.

As the type of rig employed lends itself to almost any arrangement of hatches there are usually as many rigs employed as there are hatches to be worked. Most of the ships in the trade are four-hatch vessels, occasionally five. The Philadelphia & Reading docks at Port Richmond have four unloading berths, two with four rigs and two with five. At Sparrow's Point there are two berths with three rigs each. As to speed: The Philadelphia & Reading docks handle an average of about 25 tons per hour per hatch, though this of course is not a record figure. At Sparrow's Point, a record of 2,700 tons in 24 hours with three rigs is claimed, an average of 38 tons per hour per hatch, and ordinary operation works out about 30 tons. Much depends on the ore, the Spanish ore being very light and fine and the Cuban ore heavy and moist.

All ore is unloaded into cars; no stocking on docks whatever is done. Each berth is served by two tracks, as may be seen in Fig. 3, allowing of continuous work. The type of car is the standard steel hopper or "battle ship," with the usual admixture of

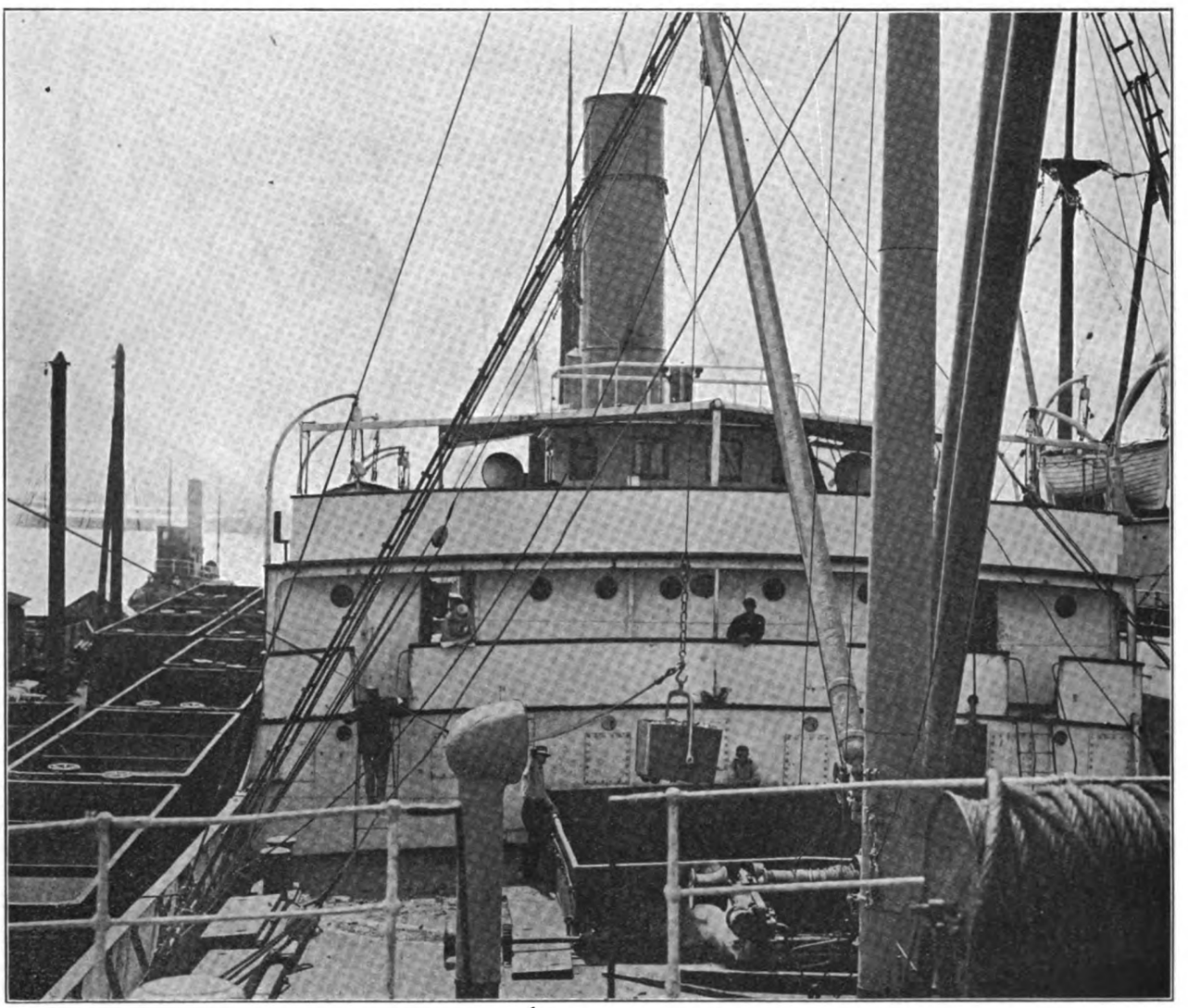

FIG. 2—SHOWING THE USUAL RIG USED ABOARD SHIP.

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gondolas. The railroads do not now do the unloading, but supply the piers or docks and cars and do the switching and the cargo is taken out by a stevedore, who supplies and operates his own rigs. Work is carried on night and day without interruption.

New Equipment.

The first step in the direction of improving dock equipment has been taken by the Philadelphia & Reading in the rebuilding of its pier 14, at Port Richmond, and equipping it with two "Brownhoist" rigs, with five-ton buckets, which will have a capacity of 300 tons per hour each. As compared with the old rigs, therefore, the apparent reduction in time is as one to six, though it is very doubtful if this will be approximated with the usual type of ship. The new rig, shown in elevation in Fig. 6, is of the fast type as built by the Brown Hoisting Machinery Co., Cleveland, and will be electrically operated, the current being supplied from the power house shown at the head of the slip.

In this type of plant, the operator travels with the trolley, and so has the bucket under his eye at all times. The grab can be swiveled so as to dig under the edge of hatch and the length of boom is such as to reach the extreme outboard edge of the hatch of any probable ship, even with hatches cut as usual on the lakes. In this, as well as in vertical clearance, the extreme probable development of ship has been anticipated.

A 60-ton hopper is provided, which can be traversed over all four tracks to allow the unloading to proceed without interruption while switching is in progress.

As shown by Fig. 4, pier 14 is being widened and extended to a length of 764 feet, and the new rigs are to be erected on the new work.

Fig. 5 shows a cross section of the new pier, from which it will be seen that the machines will span four tracks, giving double-track service for each. Ultimately, the north side of the old pier will probably also be rebuilt and extended in the same way. The construction, as will be noted, is of the most substantial and permanent nature. The present depth of water in the slips is about 26 feet, but in front of the new pier will be 30 feet at low tide. The mean tide range at Philadelphia is 5 feet 4 inches.

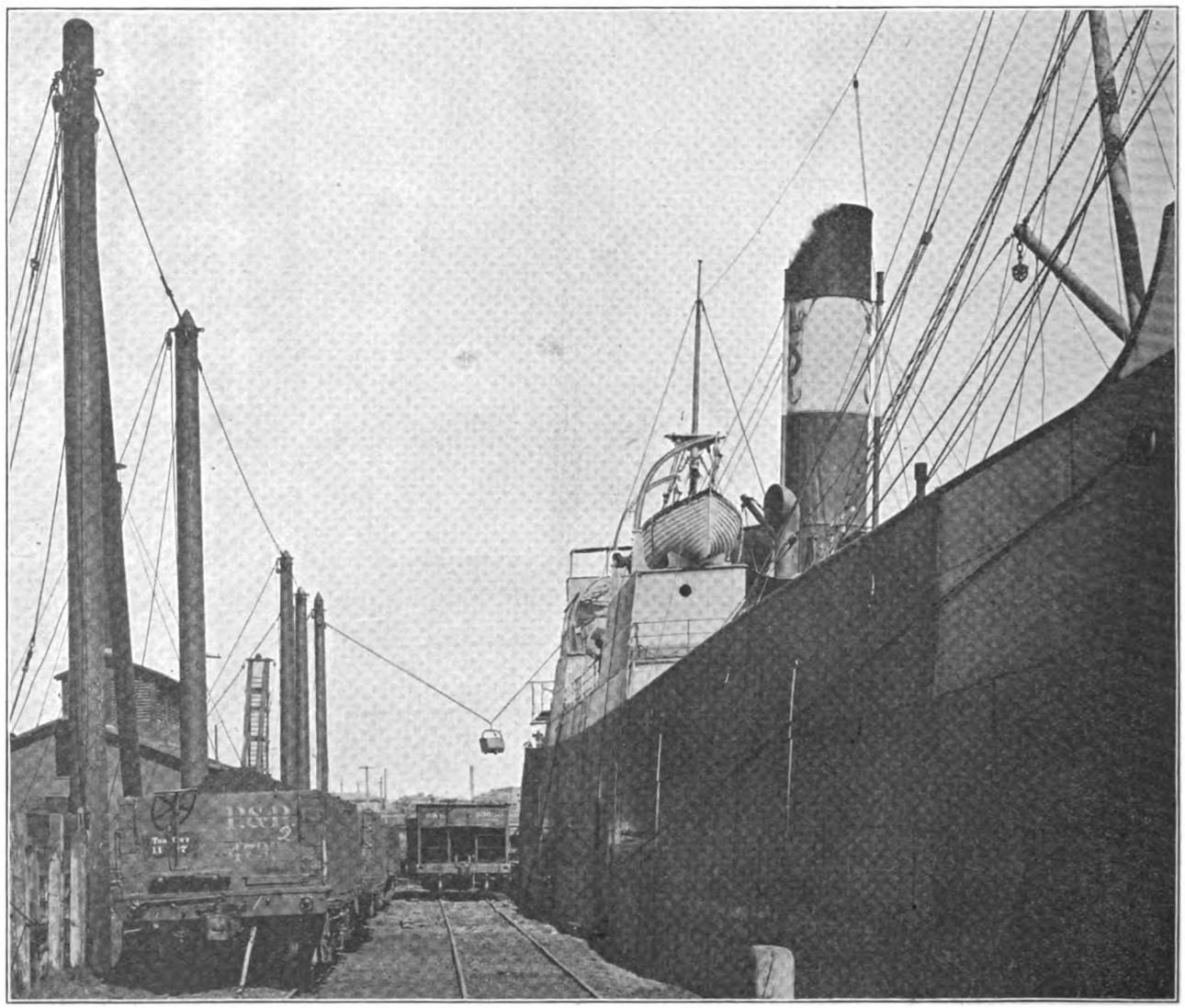

FIG. 3—SWAYING THE BUCKET OVER CAR INTO POSITION FOR DUMPING.

Itinerary Followed.

The volume of trans-Atlantic ores is largely, if not wholly, dependent upon general ocean freight conditions. With freights in a normally healthy state, very little European or Mediterranean ore comes westward, but, when ocean freights are depressed, it is possible

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to use European ores in competition with those of Cuba and Newfoundland.

Most of the ships engaged in the trade are on time charters, under which the owner furnishes the ship and crew and provides subsistence, and the charterer supplies fuel. The usual itinerary is from Philadelphia, Baltimore or Hampton Roads to Mexican ports (Tampico, Vera Cruz, etc.) or the canal zone with coal, thence to Cuba light for ore. From Philadelphia or Baltimore to Tampico or the canal zone the distance is about 2,000 knots; thence to Santiago about 800 knots, and from Santiago to Philadelphia or Baltimore about 1,400 knots. With fair despatch the round trip consumes about a month. Ocean ore freights at this time are, including unloading, $1.80 per ton from Saguntum and Bilbao, Spain; 90 to 95 cents from Newfoundland; 85 cents from Cuba, and $1.70 from Sweden. The cost to the ship of unloading averages 22 cents per ton.

The Cuban ore rate is an interesting instance of the exactly opposite condition to that obtaining on the lakes, where the ore trade is the backbone of shipping, and establishes a base for all bulk freights. The lake owner figures his up-cargo as an expense payer only and looks to his ore and grain freights for his profits, whereas in the coastwise trade the southbound coal is manifestly the chief earner, as may be seen from the fact that while during 1908 the total inward Cuban ore movement was 583,000 tons, the outward coal from Philadelphia, Baltimore and Hampton Roads only, to Tampico, Vera Cruz and canal zone only, was 671,000 tons, every ton of which was carried in foreign ships and on which the freight, unloading deducted, was about $1.10.

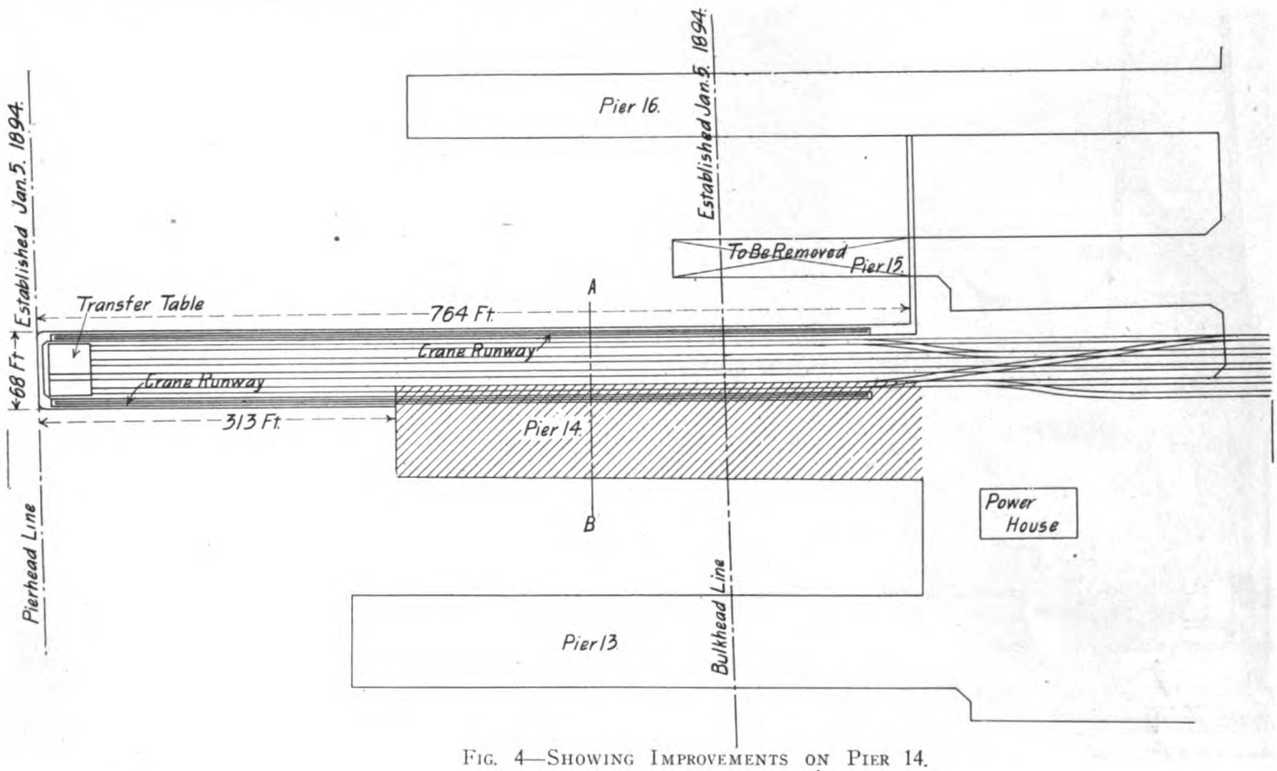

FIG. 4—SHOWING IMPROVEMENTS ON PIER 14.

Ore to be Dried.

These ships are all chartered through American shipping offices and the sole reason for their employment is their lower cost of operation as compared with American ships, not only in wages per man, but also in the number of crew and in the difference in accommodation and subsistence, as a comparison will make manifest even to the layman.

The Spanish-American Co. is arranging for drying its ore before shipment in order to drive off the 25 per

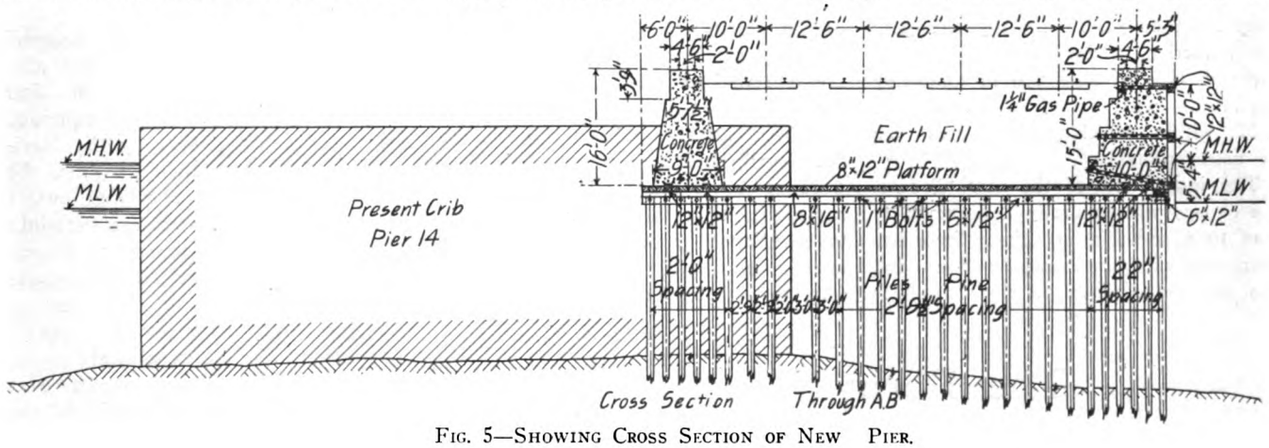

FIG. 5—SHOWING CROSS SECTION OF NEW PIER.

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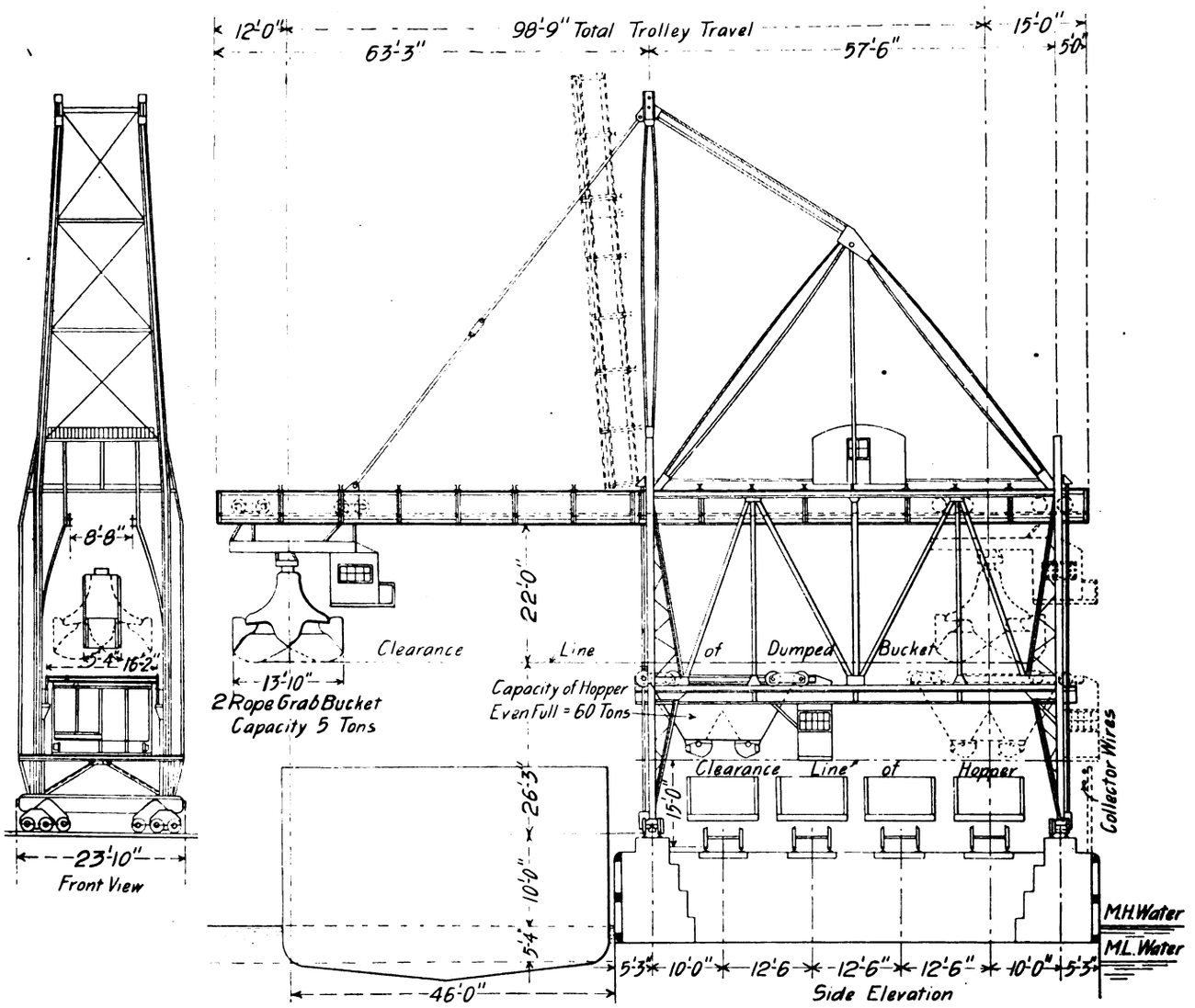

FIG. 6—SHOWING NEW RIG IN ELEVATION.

cent combined moisture which it contains, and on which both freight and duty must be paid. This, together with the reduction in duty and an improvement in type of ship and in unloading appliances will doubtless extend the field within which Cuban ores can be used profitably.

The installation of the new "Brownhoist" rigs will naturally and inevitably lead to a selection in ships. Such has been the experience on the lakes and the preference given to ships of later designs, which contributed to fast work, has even led to extensive changes in others which were only three or four years out of their builders' hands. There are a few bulk freighters at sea, recently built, in which the lake design has been largely followed, and these occasionally find their way to the Delaware or Chesapeake and doubtless the saving in time which will be found to be effected by their use will lead to an increase in their number and this in turn to a reduction in freights.

The Porhydrometer

IN the September issue of THE MARINE REVIEW a description was given of the porhydrometer, an Italian invention for weighing the cargo of ships which is attracting some attention abroad. A demonstration of its efficiency was recently given before a company of shipowners and shippers, both in London and Cardiff, which excited much comment. The Porhydrometer, literally meaning hydrostatic measure of weight, is the invention of Signor Emilio de Lorenzi. Concerning the experiments with this instrument the *Shipping Gazette* of London says:

For three years Signor Lorenzi studied the question ere he was able to perfect his first model. The first sea-going steamer to be so equipped was the Procida, owned by the Navigazione Generale Italiana. When the first experiments were carried out, a load of exactly five tons was shot into the vessel, and the amount of immersion this gave on the aerometer was carefully noted. From this basis it was possible to work out the varying immersions for different weights of cargo. All the same, when 1,000 tons had been shot into the ship's hold the experiment was continued by loading another truck containing exactly five tons. It was seen that this five tons gave exactly the extra immersion as did the first five tons and so on to the extent of the cargo. The Italian government were so interested in the proposition that they decided to make

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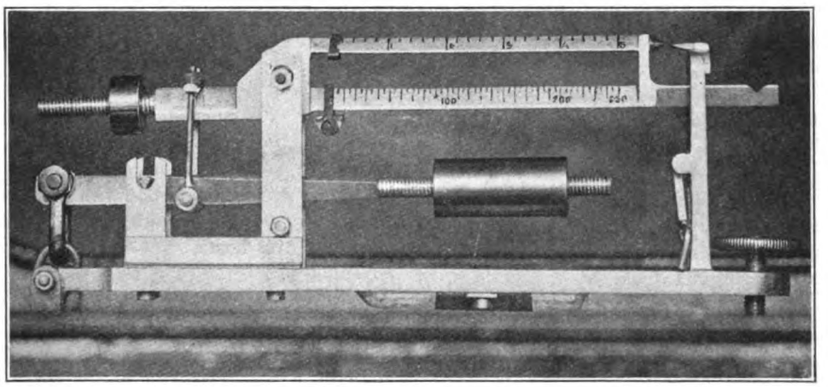
exhaustive tests, which they did, in order to satisfy themselves and their engineers. As a result of their tests and examination, the Italian government recognizes the porhydrometer as an official weighing machine. They have decreed that ships fitted with the invention shall be recognized by the customs, and that the weight of cargo registered by the porhydrometer shall be accepted as correct by the customs authorities.



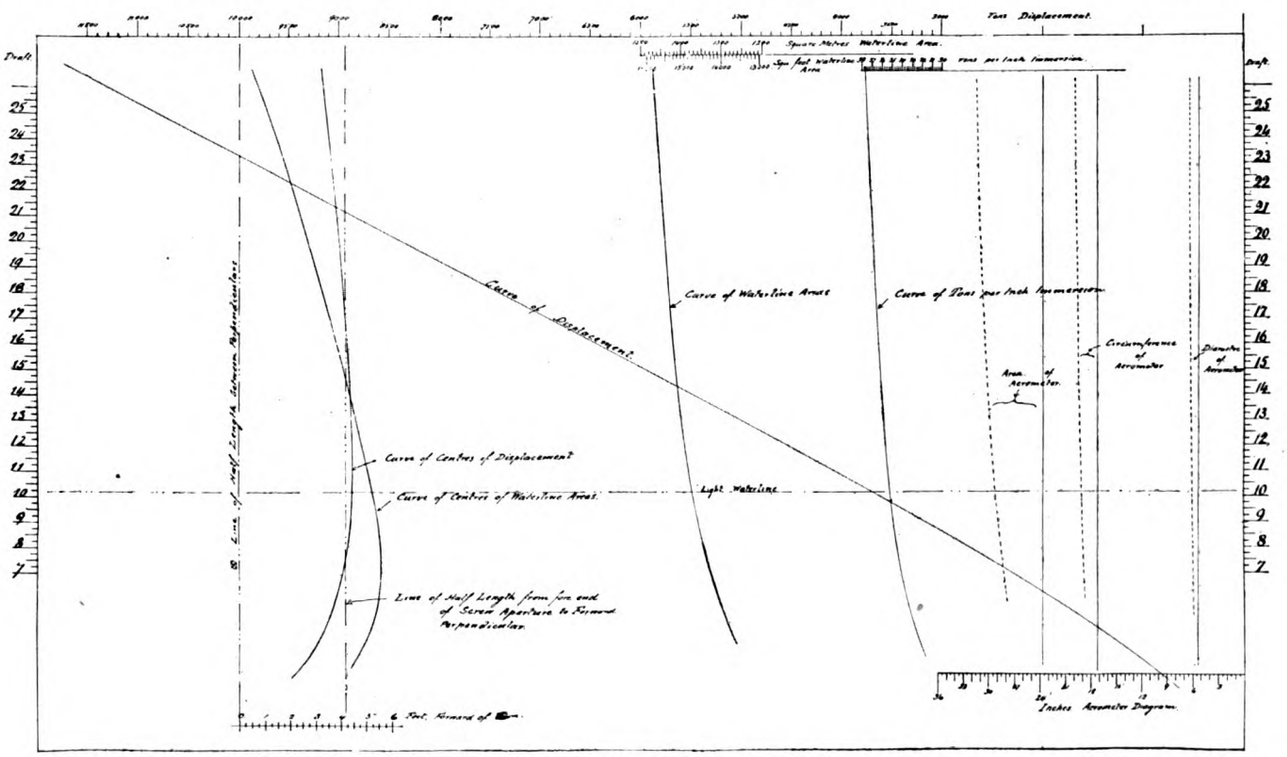
THE RECORDING INSTRUMENT.

Naturally enough, special interest attaches to the definite series of tests which, a few days ago, were carried out at Cardiff, on the cargo steamer Procida, which loaded a cargo of coal for Genoa. The Procida is a 7,000-ton carrier of the ordinary cargo type. At the demonstration about a dozen shipowning firms were represented, whilst others connected with the coal shipping business were also present. It was agreed by those present that the best way of testing the instrument was to take four wagon loads of coal—each wagon holding exactly 10 tons—and tip them one by one into the Procida's hold. The porhydrometer with which the Procida is fitted is situated in the engine room, and it followed, therefore, that those who were watching the steel-yard of the instrument did not know how much coal the ship had taken on board, except so far as it was recorded by the instrument. As wagons one, two and three were tipped into the hold the porhydrometer correctly registered 10, 20 and 30 tons respectively. Then the fourth wagon was discharged into the vessel and immediately the porhydrometer, instead of registering 40 tons as was to be expected, registered 42½. This was a surprise to those who were watching the instrument, until a satisfactory explanation was forthcoming.

And here is how the error arose.

SIGNOR EMILIO DE LORENZI, THE INVENTOR OF THE PORHYDROMETER.

Those who were superintending the tipping of the coal were anxious that the fourth wagon should be tipped well over the starboard, and to do


Tons Displacement.
Draft
Curve of Displacement.
Curve of Water-line Areas
Curve of Tons per Inch Immersion
Curve of Centres of Displacement
Curve of Centres of Water-line Areas
Light Water-line
Line of Half Length from fore end of Screw Aperture to Forward Perpendicular.
Circumference of Barometer
Area of Barometer
Diameter of Barometer
Inches Barometer Diagram.

DISPLACEMENT CURVES OF A 7,000-TON CARGO STEAMER.

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ALEXANDER MURRAY, THE CONSULTING ENGINEER.

this the coal shoot had to be considerably lengthened and brought further over the steamer's deck. Upon examination it was found that this coal shoot was, during the discharge of the fourth wagon, resting upon the steamer. As soon as the weight of the coal shoot was removed, the porhydrometer correctly swung back and registered 40 tons, as the total amount taken on board from the four wagons. Here, undoubtedly, was a good example of the sensitiveness and accuracy of the invention, and those on board the Procida were very much struck by the fact that so small a quantity of cargo was, on a 7,000-ton steamer, so accurately recorded. The general opinion seemed to be that on barges and cargo steamers carrying deadweight material there was a fine opening for the invention, whilst it would also be a useful addition to vessels of any class or description. It is pointed out that one of the many useful purposes to which the porhydrometer could be put is in deciding promptly and reliably whether or not a passenger steamer's ballast tanks are full. Yet another use would be in discovering a leak, and estimating the rate at which the water was entering the ship. Knowing this, it would be an easy matter to arrive at a decision as to the chances of the vessel being able to make port. Fitted on the mechanism is a bell, which rings if the ship springs a leak.

Shipowners, of course, are anxious to know what saving they may exppect by the adoption of this invention. Vessels fitted with the porhydrometer have to pay to the Italian government a tax of 15f. per annum. Having paid this fee they may demand that the instrument be recognized by the custom house people, and instead of having to pay 23½ centimes per ton for the weighing of the cargo on discharge they get off with the small charge of 8 centimes per ton if the ship is equipped with the apparatus. There is, of course, also a very big saving in the time of discharge. Take the port of Genoa, for instance, where, under present conditions, only 500 tons per day can be discharged without having to pay the extra hours of labor. With a porhydrometer as much as 2,000 tons can be got over the side in a day, and this is permitted if the work is done in the recognized hours of labor. Roughly speaking, it is estimated that the economy of time is about 75 per cent. All things considered, it is not surprising that the inventor is optimistic as to the future of his invention.

Duluth and San Francisco Fire Boats*

BY JOHN LISTON.

MODERN developments in the water-borne commerce of both inland and seaboard cities, with the consequent increased investment in ships, wharfage, warehouses and other property on the water front, make the problem of improving the present fire-fighting facilities one of great economic importance.

The extensive use of combustible materials which still characterizes American building construction, makes the relative effectiveness of different types of fire boats important factors in determining insurance rates. Where facilities exist for connecting the high pressure pumps of the fire boats to city mains, their sphere of usefulness is not limited to the immediate vicinity of the water front, and they have been found in many instances to be valuable auxiliaries to the land fire fighting apparatus.

While the general tendency in fire boat construction has been in the direction of larger boats and higher water pressures, local conditions must always affect their design in regard to speed, capacity and ice-breaking and maneuvering characteristics.

The practical value of a fire boat is largely dependent on the volume and pressure of the water which can be delivered by its pumping outfit. Heretofore the usual equipment has consisted of double-cylinder, vertical, inverted reciprocating pumps, each unit having a capacity of about 3,000 gals. per minute; but the high steam pressures now demanded in fire boat service can be most economically and safely obtained by the use of centrifugal pumps driven by steam turbines. This combination, when compared with the reciprocating pump equipments ordinarily used in fire boats, has the following advantages:

It shows a marked improvement in steam economy for a given amount of water delivered at the nozzles, together with a practical elimination of the strain on the hull due to vibration which is inseparable from the use of reciprocating pumps.

The absence of valve and other moving parts required in the reciprocating pump minimizes the cost of attendance and the replacement of worn parts.

The two-stage turbine-driven centrifugal pumps now in use can deliver water at higher pressure than the reciprocating pumps heretofore used, and the pressure can be readily increased by adding to the number of stages or by running the centrifugal pumps in tandem, without affecting the structure or general efficiency of the pumping equipment.

In order to obtain a maximum output with centrifugal pumps, high peripheral speed is necessary. The characteristics of the steam turbine make it especially valuable for this work, as it also is most efficient at speeds that are much higher than those obtained with any form of reciprocating engine.

At present five boats equipped with Curtis steam turbine driven centrifugal multi-stage pumps are in commission, distributed as follows: Two each in the fire departments of New York and Chicago, and one at Duluth, which was constructed for the Duluth, Missabe & Northern railway. In addition to these, two are now being built for the city of San Francisco.

The pumping equipment of the New York and Chicago boats were described in the June, 1908, and Jan., 1909, editions of the REVIEW, and the following refers only to the newer types exemplified by the boats designed for service in the waters about Duluth and San Francisco.

The details of the equipment of these boats constitute in themselves the strongest argument for their adoption by every city having water front property, which, in the event of fire, could

*Reprinted from the *General Electric Review*.

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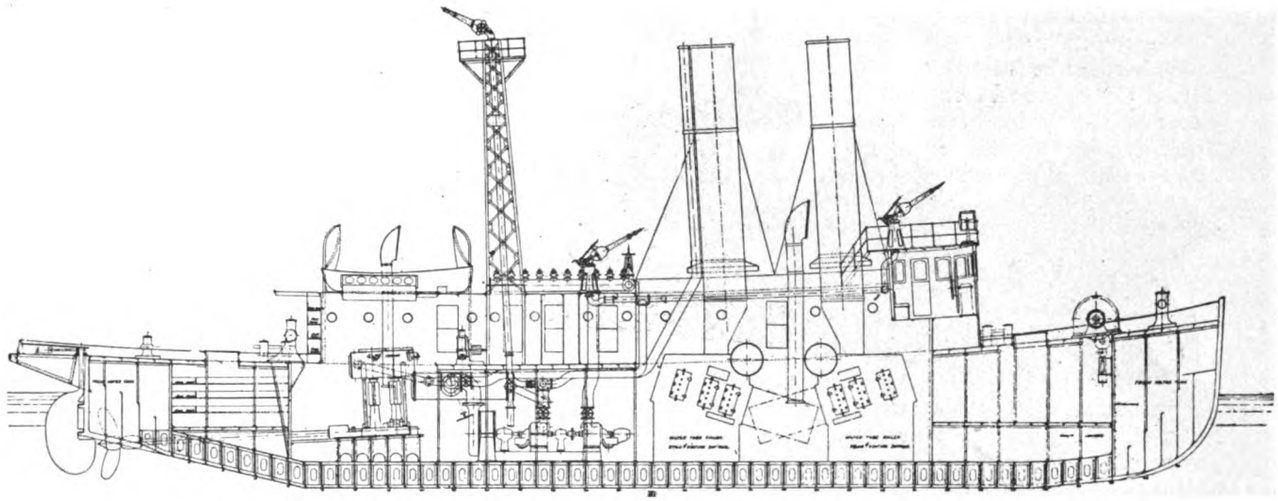
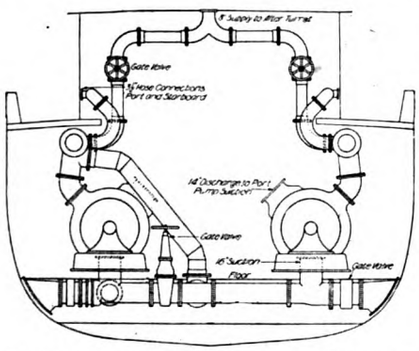


HULL CONSTRUCTION AND ARRANGEMENT OF MACHINERY, SAN FRANCISCO FIREBOATS.

not be readily protected by the ordinary land fire fighting apparatus.

The powerful fire boat McGonagle, recently completed for the Duluth, Missabe & Northern railway, forms a notable addition to the growing fleet of fire boats that are equipped with Curtis steam turbine-driven centrifugal pumps. The boat has been built to protect the iron ore docks at Duluth, Minn., and



SECTIONAL VIEW OF DULUTH FIREBOAT SHOWING LOCATION OF PUMPING SETS AND ARRANGEMENT OF PIPING.

its pumps can deliver 12,000 gals. of water per minute at a pressure of 150 lb., under normal operating conditions.

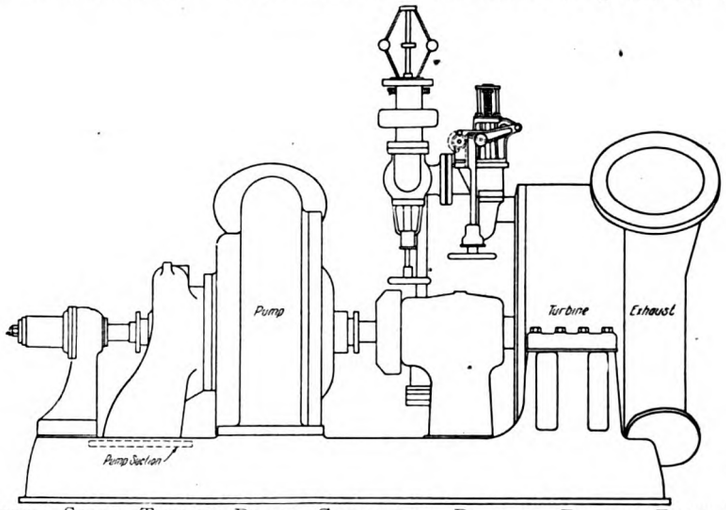
The general dimensions of the boat are: Length over all, 120 ft.; beam molded, 28 ft.; depth molded, 15 ft. The pumping equipment consists of two sets of two-stage centrifugal pumps, each driven by an 800 horsepower horizontal shaft Curtis steam turbine; each pumping set when supplied with steam at a pressure of 180 lb. per sq. in. and operating with 28 in. of vacuum, delivering 6,000 gals. per minute at a pressure of 150 lb. These two sets can be operated in series to obtain double pressure, and are tested for a pressure of 300 lb. per sq. in. The compactness and accessibility of these sets, together with the general arrangement of the pumps, piping and turbines, is shown in lower cut on opposite page.

There are three main turret nozzles, one mounted on the main deck forward, one on the top of the pilot house, and the third on the top of the deck house aft. In addition to these, there are 12 valves for the auxiliary fire streams, distributed along the sides of the deck house.

The service for which this boat is intended and the waterways in which it will maneuver render the attainment of a relatively high speed desirable, and during the speed trials an average speed of about 14 miles per hour was maintained. The boat is heavily constructed and is propelled by a single screw driven by a double vertical high pressure engine having two cylinders, each 20 in. in diameter by 24-in. stroke. Steam at a working pressure of 180 lb. is supplied by two Scotch boilers 13 ft. 9 in. in diameter by 11 ft. 6 in. long.

The guarantees on the pumping equipment called for a steam consumption of 30,000 lb. per hour when the sets were operating at their full rated capacity, but during the exhaustive tests to which the boat was subjected before being accepted, it was demonstrated that the actual steam consumption under these conditions amounted to only 25,880 lb. per hour.

The pumps and turbines are direct connected and are mounted on a common base, their normal speed being 1,800 revolutions per minute. The turbines are provided with both automatic and hand-controlled governors, and a relief valve is also supplied to prevent injury in the event of a failure to maintain the vacuum.



CURTIS STEAM TURBINE DRIVEN CENTRIFUGAL PUMP ON DULUTH FIREBOAT.

Electricity is employed to light the boat, and a powerful searchlight is located on top of the pilot house, current being supplied by a 10 kilowatt marine generator set of General Electric manufacture.

The following non-technical description of a test of this fire boat, taken from an account which appeared in a local paper, the Duluth *News Tribune*, indicates that the McGonagle has fully

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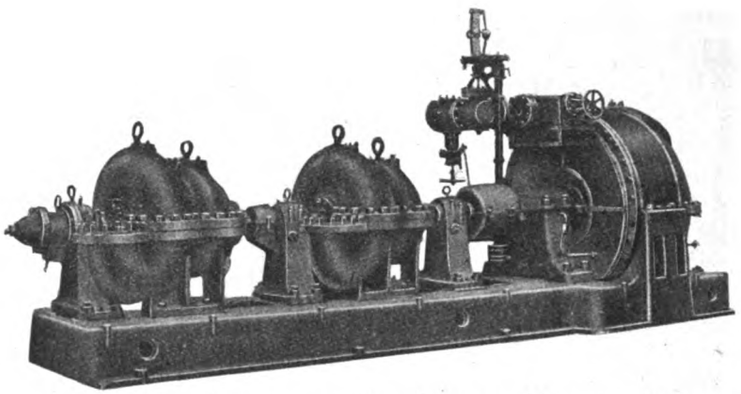

ONE OF THE PUMPING SETS FOR THE SAN FRANCISCO FIREBOATS, SHOWING TWO MULTI-STAGE CENTRIFUGAL PUMPS DRIVEN BY CURTIS STEAM TURBINE.

met the requirements of her designers:

"The new fire tug, William A. McGonagle, owned by the Duluth, Missabe & Northern railway, has been given a thorough test of ability to throw water.

"The big fire fighter, when working at her full capacity, will throw 12,000 gals. of water a minute and a stream 400 ft. long. During the test the machinery and pumps worked perfectly and all who witnessed it, including members of the city fire department, officials of the city, several of the government engineering department, and a large number of citizens, besides the railway officials most interested, were convinced of the tug's efficiency for which it was built."

The pumping equipment for the two fire boats, David Scanwell and Dennis T. Sullivan, now being built for the San Francisco fire department, differs somewhat from that of the Duluth boat, in that each turbine is direct connected through flexible couplings to two multi-stage centrifugal pumps, all three units of each set being mounted on a common bed-plate. Two of these sets are required for each boat.

Each pump of each set is capable of delivering 2,250 gals. of water per minute against a discharge pressure of 150 lb. per square inch, the two pumps pumps of each unit being so designed that they may be operated either in parallel or in series. When operating in parallel, they deliver 4,500 gals. per minute at 150 lb. pressure, and when operated in series, 2,250 gals. per minute at 300 lb. pressure. These ratings apply when the suction head is zero.

Largest Pier on the Atlantic Coast

BOSTON now has the largest pier for commercial purposes on the Atlantic coast. It is 780 ft. long and 240 ft. wide. It is now in service and is occupied by the Cunard line.

The pier is one of several to be provided at the East Boston terminal of the Boston & Albany railroad, and was built by the New York Central & Hudson River railroad, which leases and operates the B. & A.

The New York Central is building another pier east of this, which will be a little larger. It will be finished next January and will be occupied by the Leyland line.

The New York Central is also building at this terminal a new grain elevator with a capacity of 1,000,000 bu.—the largest in New England. It will have a modern grain dryer attachment.

The new grain elevator and grain dryer and power house will cost $1,500,000. The new piers will cost over $700,000 apiece, and the expense of rebuilding and rearranging this great terminal at East Boston stands the New York Central road about $4,000,000.

Some Comparisons.

The dimensions of the new pier, 780 ft. by 240 ft., do not convey its full size to one unaccustomed to figures. It is 29 ft. longer than the capitol at Washington. Mauretania, the largest steamship afloat, could easily dock at this pier on one side and Lusitania could easily dock on the other side of the pier at the same time. When the new pier for the Leyland line is built, four ships of the size of the Mauretania could dock at the same time, could all unload their freight and passengers at the same time, could all unload grain at the same time, could all take coal or freight from lighters at the same time, and, if bigger ships are to be built they can come in too, for at these berths there will be 35 to 40 ft. of water at low tide.

On B. & A. pier No. 3 alone 43,880 soldiers could stand on squares of 2 ft. and on the two piers, Nos. 3 and 4, the entire army of the United States could be assembled. Five hundred and twenty-eight freight cars could be placed on the pier. The new grain elevator will be 186 ft. 6 in. from the base to the ridge pole. The elevator will be 269 ft. and 8 in. long and 73 ft. wide.

The largest piers in New York are on the North river, between West Fourteenth and West Eighteenth streets. There are three of them, each 825 ft. long and 125 ft. wide, and each has an area of 103,125 sq. ft. B. & A. pier No. 3 (Cunard line) has an area of 175,520 sq. ft., and B. & A. pier No. 4 (Leyland line) will have an area of 187,200 sq. ft.

Like so many other great enterprises, the rebuilding of the East Boston terminal was brought about by fire. On July 8, 1908, a fire started at the terminal in the afternoon, and, in an hour, all but one of the piers and the grain elevator were in ruins.

Size of the Slips.

A most important part of the new terminal is the new slips. The government of the United States is spending $8,000,000 in dredging the harbor so that the largest ships can get in at all times. The slips between the new B. & A. piers are each 250 ft. wide and have a depth of 35 to 40 ft. at low water.

B. & A. pier No. 5 will be built and will be equipped for handling quickly the heaviest sort of cargo freight, such as ore and heavy bulk freight.

Present Condition of the Work.

B. & A. pier No. 3 (Cunard line) is now in service; B. & A. pier No. 4 (Leyland line) will be ready next January. B. & A. pier No. 5 will be built as stated above. The new grain elevator will be ready in the autumn of 1910. Already the old freight sheds on Marginal street have been torn down, later the old locomotive round house and turn table will also come down; the office building will be moved across Clyde street to make room for the new power house and all the room thus secured will be needed for the new elevator and dryer and the service tracks.

A round house and a new freight

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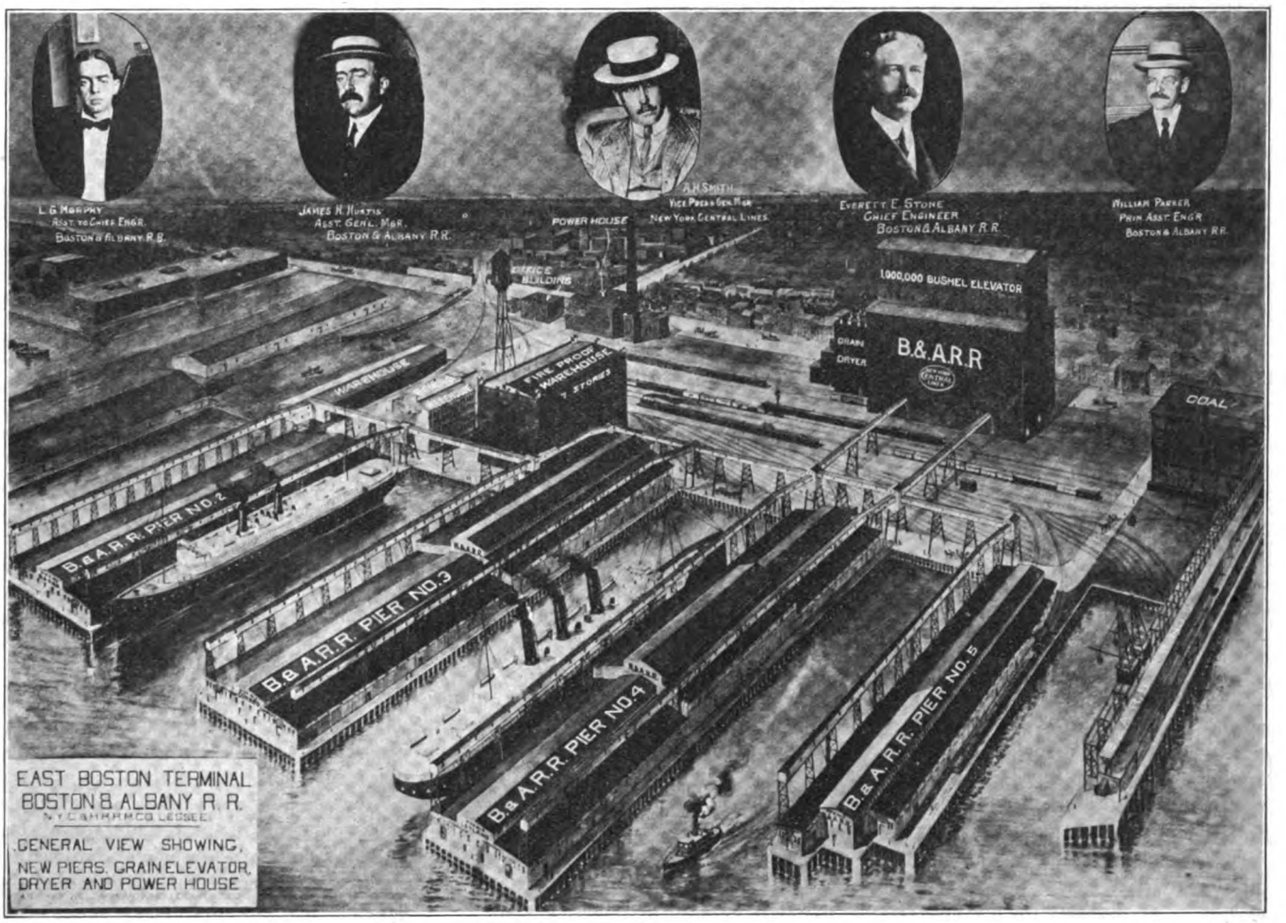

house will be built on the Boston & Albany property at Porter street.

A very important factor of the new terminal is the new arrangement of tracks running to the new piers and the new elevator. They have been placed so that the switching in and out from the piers and the elevator may be accomplished with the greatest facility.

Electric Motive Power.

The elevator will be electrically propelled and the grain conveyors operated by electric motors. The whole terminal will be lighted and heated from a new power house quite separate from the piers and located in the northwesterly portion of the terminal.

One great feature of the new piers and buildings is the extent to which fire-proof and fire-resisting materials have been used. Floors, walls, ceilings and roofs are all protected. There are 3,800 water sprinklers throughout pier No. 3, and fire pumps and automatic fire alarms will be provided. Larger water mains from the city's pipes will be laid and a salt water fire service will be installed. In fact, the fire protection throughout is most modern and complete.

As both the Cunard and Leyland lines bring passengers as well as freight to Boston, accommodations for first and second class passengers and immigrants are provided on the new piers. The rooms for this purpose will be in the second stories of the pier buildings. There will be quarters for the customs officers, health officers and rooms for baggage inspection and the physical examination of immigrants.

Elevators for passengers and baggage will run from the main to the second floors of the buildings and there will be ample room for carriages to drive in to take up or set down their fares.

There will also be wide driveways for teams and drays so that the teaming in and out of the yard can be carried on with the greatest facility.

Immediately after the fire of July 8 last, the preparation of the site for the future structure was commenced, contracts being awarded immediately for clearing the debris on the land portion, consisting of the ruins of old brick walls, all stone foundation walls and old structural steel from the burned building. Over the water section, which was the greater part of the area, the old piles remained, being burned only at the tops, and a contract was made for the removal of these, a great portion being carried to a distant part of the harbor for storage pending reconstruction.

As soon as the westerly portion of the site was sufficiently cleared, dredging operations were commenced, it being the desire of the railroad company to greatly increase the width of the dock on the westerly side. Dredged material had to be carried to outside the harbor limits, as required by law, as there was no place at the terminal where it was possible to deposit it, the desire being, in all cases, to increase the dock capacity by additional dredging rather than by filling in at any place.

Clearing and dredging operations having been completed it was possible to begin on the foundation for the structure, which, outlined in general, is 780 ft. long and 240 ft. wide, with a building 10 ft. less in width than the wharf itself, this giving 220 ft. as the width of the pier building, allowing 10 ft. for platforms on each side; the length being less than the wharf itself to an amount equal to the width of the end platform, 8 ft., thus giving about 772 ft. for the extreme length of the building. There are two tracks in the center of the pier.

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The pier is divided into seven sections by a longitudinal fire wall between the two tracks and three transverse fire walls.

The northerly half of the structure has two stories, the second story being for passenger accommodation.

The Substructure.

Concerning the substructure of the building: There is a central core over a portion of the land end, which is of solid earth, this being taken advantage of to obtain permanent foundations for certain of the steel columns and for the support of tracks through that portion of the house. The greater portion of the pier, however, is over water. Much difficulty was encountered over a portion of the work, due to the sunken debris resulting, in part, from the recent fire and, in part, from a disastrous fire which occurred in this same place in 1895, where a pier substantially the same width as the one now under construction and 300 ft. long., was entirely destroyed.

The foundation is practically all supported by piles, those on the land portion, where permanent masonry piers are used, being to some extent spruce, as they are entirely covered with earth. A large proportion of the shorter piles used throughout the structure were old piles recovered from the site of the new pier, or the best of the piles from the site of the other piers burned at the same time. All piles for the permanent support of the building at the steel columns are oak and, on account of the difficulty of getting long oak piles, a great number of them were spliced and lagged to get greater length and frictional resistance, the entire site being what is known as "friction ground", there being no hard bottom within a reasonable distance of the surface that could be reached by piles of any ordinary length. Where longer piles were needed than it was possible to obtain in oak, and where it will be possible, in the future, to make renewals, Southern yellow pine piles were used.

The total number of piles used throughout the pier structure was about 6,000.

The lumber for capping of piles, and framing of the substructure throughout, where strength and resistance to decay is required, is long leaf southern yellow pine. Wood preservatives were freely used on the outer portion of the structure, where it is subject to moisture other than the sea-water and, for the wave-stop which surrounded the land core to prevent the waves acting upon the earth, the timber was covered with three coats of teredo proof paint to retard the action of sea worms which are becoming active in our harbor, but which, however, do not seriously affect oak and some other timber, especially if the bark is on.

Concrete Apron on the Pier.

On the outer edge of the pier from a distance of 2 ft. below mean low water to mean high water, about 12½ ft., there is a tight wall of 6-in. thick timber, and from the top of this to the level of the platform of the pier, there are concrete slabs, openings only being left in the slabs sufficient for ventilation. All timber in the immediate vicinity of the ventilation openings is protected with fire resisting material. The object of the continuous curtain of timber and concrete is to prevent floating, burning debris, or burning oil, from reaching the interior of the structure.

The platform, 10 ft. wide, outside of the pier building, which is subject to fire exposure, is made of a solid reinforced concrete slab 8 in. thick. The floor of the pier inside of the walls of the building is of heavy timbers supporting 3-in. planking. On the planking, to prevent the passage of fire, is laid two layers of 4-ply plaster board and, on the plaster board, to protect it from injury in case of renewal of the wearing surface of the floor, is matched boarding ⅞ of an inch in thickness. The wearing surface which is subject to renewal is of 2-in. hard pine plank.

The plaster board referred to is a material which has been tested repeatedly by the Factory Mutual Insurance laboratories and shown to be one of the best fire resisting materials known.

The tracks in the center of the building previously referred to are depressed below the general floor level, so that the floor of cars is approximately on the level of the main floor of the building. As a fire stop at this place a curtain wall of cinder concrete is used. It is, therefore, seen that, with the exception of protected ventilating openings, the substructure of the pier is enclosed by practically continuous non-inflammable material.

Similar construction to that of the outside curtain wall is used throughout, under both the longitudinal and transverse fire walls; that is, from below low water to a point at a height where timber is always wet, there is a continuous 6-in. sheathing and, above this point, a solid concrete wall up the level of the finished floor, from which level the fire walls of the superstructure begin. The arrangement of the number of rooms above referred to was decided upon to prevent the rapid spread of fire, and was the subject of much consideration on the part of the railroad company's engineers in consultation with the underwriters, chamber of commerce and the building commissioner of the city of Boston, as was also numerous other details of construction relative to the fire resisting features of the building.

In connection with the substructure, it is necessary to provide excessively heavy outer corners to receive the impact of the steamers as they are docking, especially when there are adverse winds and tides. Belaying posts of reinforced concrete are provided at frequent intervals in the outer platform, heavily braced and tied to the superstructure.

Two-Story Superstructure.

The superstructure is practically of steel frame construction throughout, consisting of two main spans of about 73 ft., with a central pair of spans about 36 ft. each, the central support being between tracks, thus leaving the main thoroughfare for heavy teaming and general business in the outer 73 ft. span which will be free and clear of all posts or other obstructions. The fire walls are of steel frame throughout. The outer walls, where not made up of doors or windows, are covered with corrugated reinforced asbestos siding, a material absolutely incombustible, an excellent non-conductor of heat and a most excellent material for pier construction where the structure has to withstand the tremors due to the impact of vessels when docking.

Immense Cargo Space.

On the first floor, with the exception of small areas required for offices in the north end, the entire area is available for cargo. Offices and other conveniences necessary, both on the first floor and on the second floor, are made, so far as practicable, of incombustible material similar to that previously described in other parts of the structure, except that in one or two rooms, where special precautions have been taken, walls and ceiling are entirely of brick or terra-cotta and, where sanitary conditions are necessary, asphalt or similar material has been used to admit of thorough cleaning.

In addition to the offices on the ground floor, a room for perishable freight is provided so that it can be heated if desired, and there are proper conveniences for the stevedore's gear. There is also a parcel room on the ground floor for the steamship company's patrons.

Passenger Accommodations.

There will be drop stages on each side of the pier, operated by special machinery, to adjust themselves to the receipt of the gangways from both the

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first and second cabin apartments of the ships, thus making it possible to very conveniently accommodate, without unduly steep inclines, the passageways from the ships to the upper floor of the pier where the accommodations for the passengers are.

There is a separate commodious room 108 by 220 ft. for the special use of first and second cabin passengers and their baggage. This room contains convenient and up-to-date toilet accommodations, rooms for the United States appraisers and other offices. From this room there are several exits provided, in addition to two elevators, either of which can be used for passengers or baggage. These elevators will land on the main floor where patrons can take their carriages directly at the elevators, and, at the same time, be in close touch with their baggage as it comes from the room above. This being on the main floor of the building it will be entirely under cover.

Concerning the handling of baggage: special outstanding stages, operated by special machinery, are provided so that baggage may be rapidly received directly from its place at the hatches of the ship onto trucks stationed on the outstanding stages and be distributed through the baggage rooms; the first and second cabin coming out first and, later, the steerage baggage which, of course, occupies large areas for the purpose of convenient examination.

New Grain Conveyor.

The new 1,000,000 bushel grain elevator will be located on the southerly line of Marginal street. It will be 269 ft. 8 in. long by 73 ft. wide, and have a total height of 185 ft. 8 in. from the base of rails of track in the yard to ridge of the cupola roof. The main structure will contain the steel storage bins 72 ft. in depth, elevated to admit of the passage under them of grain cars over two tracks. In the basement below the track level there will be the machinery for car pullers, the boots for elevators, the boots, in turn, being contained in watertight tanks.

Above the tanks there is the distributing story, this distributing story being surmounted by a cupola 44 ft. wide by 86 ft. high, extending the entire length of the building and divided into four stories, the floors being called the "conveyor floor", "scale floor", "garner floor" and "top floor".

The elevator will be a fireproof steel structure, the main building enclosed with brick walls and the cupola with terra-cotta. The foundations will be of concrete, resting on piles. Floors will be of reinforced concrete and the roofs book tile laid on T-irons and made water tight with felt and gravel roofing.

The business of the elevator will be to unload and load cars and to load ships, including the necessary transfer, drying and cleaning of grain involved in these processes.

The elevator will contain nineteen elevators of which six will be receiving elevators designed for unloading cars and will be provided with power shovel apparatus; six shipping elevators for unloading purposes; five transfer elevators for cleaning and transfer purposes and two for serving the grain dryer.

It is expected that the elevator will be capable of unloading 300,000 bushels in 20 hours and shipping 40,000 bushels per hour into the holds of vessels.

All the machinery of the elevator, as well as the belts of the entire conveyor system on the piers will be operated entirely by electricity generated at the power plant at the terminal.

Grain Conveyor System.

From the southerly side of the elevator, that is, the side towards the docks, there will extend, from two points, conveyor galleries, extending to towers at or near the head of the docks, from which place lines, either double or single, will start to reach the sides of the various docks, all galleries being supported on steel trestle bents and composed themselves of steel trusses with fireproof floors, sides and roofs. The fireproof material being reinforced concrete for the floors, book tile for the roofs, and some form of asbestos material for the sides.

The galleries, when over pier buildings, will be of steel construction, the steel bents being supported on the steel trusses of the structure.

The grain will be conveyed to the various galleries from the bins in the elevator by means of rubber belts, varying in width from 24 in. to 36 in. running on a multitude of steel rollers, the belts in the galleries being all 36 in. wide.

The power for running the belts is provided by electric motor units stationed at different points throughout the system in the various towers, the electric power being conducted to them by wire from the main power house through the galleries by an extensive and carefully guarded system of wires. The speed of the belts is about 1,200 ft. per minute, so that 10,000 bushels of grain per hour can be conveyed to any point along the side of the vessels and directed by means of proper trippers and dock spouts, to and through the hatches of the vessel, the dock spouts, being so stationed that any hatch of any vessel can be reached by some one of the numerous spouts.

There will be a total of about 6,000 ft. of grain conveyor galleries, making a total of 7,300 linear ft. of belt conveyors, counting these in both double and single galleries.

New Switching Tracks.

The extensive changes at this terminal have called for an entire remodelling of the track system. The general features of the track system, as now planned and being executed, are as follow:

Lying parallel to Marginal street and between the street and the piers is an extensive yard of the terminal type, having its entrance and exit at the westerly end. It is divided into five general groups of tracks, each group separately connected to the main switching leads. On each pier are two tracks also connected to the same switching leads, also two tracks in the grain elevator.

The central group is composed of a number of straight tracks which will be used for the reception, making up and departure of long trains of cars.

The other four groups will be used for the sorting and storage of cars, for delivery to the elevator and the various pipes, one group being assigned to the elevator and one each to Cunard, Leyland and general pier, with additional tracks for the Clyde street and coal piers.

The arrangement is such that switching operations may be carried on in each group without interfering with any other group, in fact, if required, six or even seven locomotives might be at work in the yard at one time without interference.

Some idea of the extent of this yard may be gained when it is considered that there are over five (5) miles of track; that it will require 325 tons of steel rail, and that 80 frogs and switches are required to accommodate the various train movements.

The work of loading or unloading may be carried on on 110 cars at one time, all within the lines of the pier sheds, and 430 other cars may be stored on the adjacent tracks awaiting their turn to enter the sheds, making a grand total of 540 cars within the limits of the yard at one time and still there will be plenty of room for all necessary switching.

The Clara Brooks, a fine new barge arrived at Charles Rohde & Sons' ship yard at Baltimore, Md., on Sept. 28, from Madison, Md., where she was built by Joseph W. Brooks. The Clara Brooks is 197 ft. long and 23 ft. beam and 13 ft. molded depth and will carry 1,000 tons dead weight.

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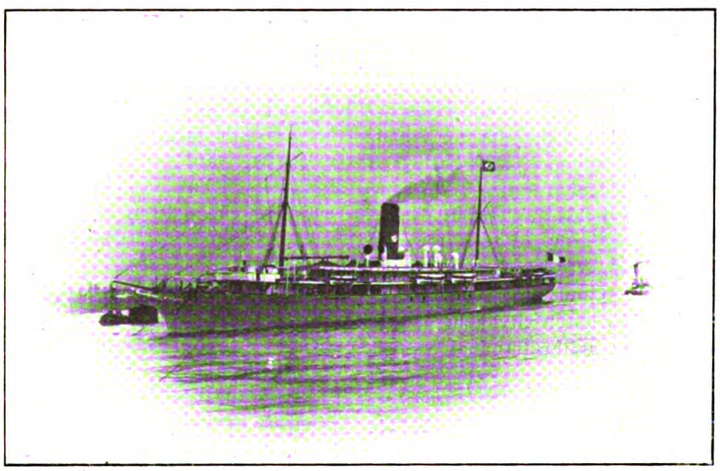
TWO NEW TURBINE STEAMERS.

An important development in the Peruvian mercantile marine service is about to be inaugurated by the Compania Peruana de Vapores of Dique del Callao, with two new turbine steamers which have just been completed by Messrs. Cammell, Laird & Co., of Birkenhead, Liverpool. The Peruvian steamship company just named is subsidized, as far as ships are concerned, by the Peruvian government, and its purpose is to push forward the trading and mercantile marine interests of the republic, and to maintain fast mail, passenger and freight services. It possesses other interests, too. At Callao the company owns one of the largest floating docks in the world. With the approval of the Peruvian government, the company placed in the hands of Messrs. Cammell, Laird & Co. a contract to build the first two liners, and these —the Ucayali and Hullaga—just completed, although having a contract speed of 18 knots, have both established their capacity for exceeding 19 knots. They are also unique in being the first oil-driven turbine steamers on the South American coast. They have palatial passenger accommodation, and unique cargo facilities specially adapted to the trade of the coast, including on the upper deck a covered area 60 ft. in length, to be used as a market for merchants at the coastal ports of call.



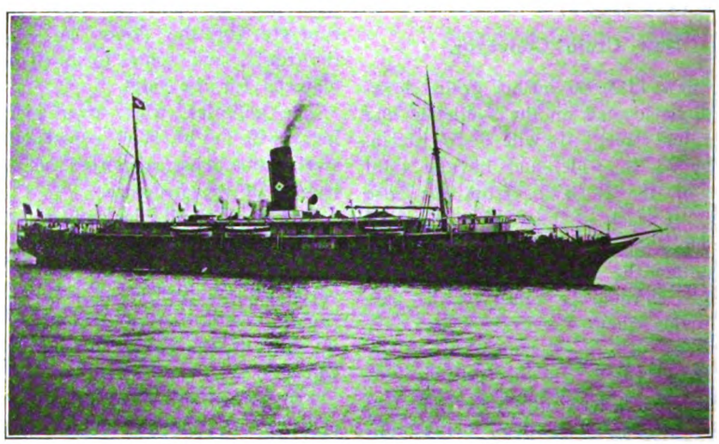
PERUVIAN TURBINE STEAMER HULLACO.

These steamers in general appearance possess the graceful lines of a yacht. Their dimensions are: Length over all, 375 ft.; beam, 46 ft.; giving a gross tonnage measurement of 3,300, and a loaded displacement of over 6,000 tons. The fittings and the design of the public rooms are of a beautiful and unique type, and a general air of brightness is given to the exterior and interior of the saloons, cabins and deck houses by the use of Robbialic white enamel. The accommodation for the 112 first, and 95 second class passengers is ranged along the center line of the ship on the shade and spar decks. There are four decks in all, and the accommodation houses, commencing just abaft the breakwater forward and extending aft to the stern of the vessel afford an exceptionally long and sheltered promenade on both passenger decks, whilst numerous deck seats add materially to the comfort of the traveller.

The propelling machinery constructed by the builders of the ships consist of a set of Parson's compound steam turbines driving three shafts; the high-pressure turbine drives the center shaft, and each wing shaft is driven by a low-pressure turbine, the reversing turbines being incorporated on the low pressure turbine. The turbine cases are of cast iron, and the motors are built up with cast steel wheels and forged steel drums; all revolving parts are accurately balanced, the glands of the turbines are steam packed, and generally the construction conforms throughout to Messrs. Parsons' latest designs. The boilers are four in number, two double-ended and two single-ended of the cylindrical return tube type, constructed for a working pressure of 160 lb. per sq. in. They are worked on the closed stokehold system, of forced draught, four fans being fitted for supplying air to the fires.

An oil fuel arrangement is supplied and fitted, which can be put in operation at any time after removing furnace bars, bearers and bridges for coal burning and replacing these by the special furnace fronts, burners, etc.

Both vessels go out to South America with coal fuel, but there they will be adapted for the regular use of oil fuel.



PERUVIAN TURBINE STEAMER UCAYAH.

NEW SHIPYARD FOR SEATTLE

E. W. Heath of Tacoma, who has constructed some 60 of the wooden vessels now plying the waters of the Pacific coast, has purchased a tract of land on the Duwamish river in South Seattle to which point he expects to remove his ship building plant in the near future. The plant is now located at Tacoma. He will construct new docks and buildings and add new equipment, spending in all about $25,000 in new facilities at the Seattle plant.

Charles M. Power, secretary and general manager of the Seneca Chain Co., Kent, O., has resigned his position and went to Pittsburg Oct. 1, to assume his new duties as general sales manager of the Standard Chain Co.

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IMPROVEMENT IN SHIPPING.

H. E. Moss & Co. in their latest steamship circular give voice to quite a feeling of optimism over trade contions. They say:

In our circular of January 1 last, we stated that the year 1908 had been about the worst on record for shipping, and the crisis was then most acute. We also gave our reasons for saying that we were on the eve of a gradual improvement. The intervening six months have certainly been bad enough in the majority of trades, especially in the North Atlantic, but at the present time, without doubt, there is a better feeling throughout the world, and freights in many directions have sensibly improved, although still far below what they should be, or what we may reasonably expect them to be. Modern tramp steamers can now be worked in order to at least pay interest and depreciation, which for some time past has been impossible. The tonnage laid up has been reduced to less than one-half, and what remains is practically out-of-date, and cannot compete with modern vessels. The amount of obsolete tonnage is still enormous, fully 1,000,000 tons. Many companies and owners have realized that the sooner it is demolished the better, and they have been gradually selling their older steamers for this purpose, and replacing them by more modern vessels. The sooner the rest are disposed of the less will be the ultimate loss.

There is no doubt that the late American crisis, which was mainly responsible for our recent troubles, has passed away, and trade in the states is now gradually assuming its normal aspect. We have always maintained that any improvement in the United States is a good harbinger. We are glad to say that this improvement has already reflected on trade, not only in this country, but also abroad, and the severe depression we have so long endured is gradually disappearing. These facts, combined with the lessened output of new tonnage, prove to our mind that we are on the eve of better times, which will not be long in coming, and steam shipping is always the last to feel the effects of any general improvement in the trade of the world.

Ship builders have felt the depression more than ever before. They still feeel it, and will continue to do so, though less acutely, until the supply and demand for steam tonnage are again balanced. Many yards have been practically without orders, and the contracts which have been taken have been at a loss, in order to keep the establishments going.

Some far-seeing owners have taken advantage of the low prices ruling and ordered new tonnage, a fairly large amount having been placed in the early part of the year, chiefly on the Clyde, and recently on the east coast. The result of this has been that many builders have secured a few orders, but at wretchedly low figures.

The prices for building steamers were never lower, mainly through the improved means of construction builders have now adopted. Undoubtedly the bottom has been reached. New steamers of 6,000 to 8,000 tons with fair specifications can now be placed at about £5 5/- per ton on the dead weight, and other sizes in proportion. Most of the new steamers left on builders' hands two years ago, have been disposed of, and the majority of bargains in the way of comparatively new steamers have been picked up, indeed, throughout the recent crisis, it is astonishing how few forced sales have taken place, thus proving that the bulk of shipping is held in much stronger hands than formerly. Second-hand steamers have been difficult to sell, and there are few buyers. The depreciation of this class of property is far greater than that of new tonnage, and large numbers of old steamers are presently for sale.

Not many new developments in ship building and marine engineering have taken place, except we may instance the unrivaled performances of the Cunard Co.'s latest turbine steamers —the Mauretania having recently averaged 25½ knots across the Atlantic. Great results are expected from the mixed engine (turbine and reciprocating combined), but these remain yet to be proved. The internal combustion engine has made much progress, and for small craft especially has been successfully applied. A great future is expected from this class of machinery.

TRANSPORT DOCKS IN SAN FRANCISCO.

The United States are now having constructed three very large transport docks opposite Old Fort Mason, in San Francisco, which, when completed, will be the largest on the Pacific coast.

These immense piers will cost, when finished, in the aggregate about $2,000,000, and will require over two years in building. The contract for the building of the docks proper was let last October to the San Francisco Bridge & Construction Co., of San Francisco, for the sum of $1,182,200. The contract calls for the completion of the three piers within 30 months from the date of the award. Active work was commenced at once, and has been pushed forward with all vigor ever since.

The above price does not include the complete improvements to be made at that point—according to plans made for the same by Messrs. Rankin, Kellogg & Crane, architects, of Philadelphia. Contracts for the full completion of the work will soon be let—when the present improvements are sufficiently progressed. The entire work is in charge of Major George McK. Williams, constructing engineer quartermaster, assisted by Otto W. Degen, civil engineer, quartermaster department.

The sea wall will be 1,023 ft. long, constructed of the best reinforced concrete, and will start from the northeast corner of Laguna and Tonquin streets, thence along the north edge of Tonquin street 688 ft., and north 123 ft., and thence 212 ft. to the Old Fort Mason military reservation.

This wall will be 25 ft. at the base, and 57 ft. high; depth in front of the sea wall will be 32 ft. at low tide. A crib wall will be constructed on the east side of Laguna street, to the reservation line about 600 ft. of sunken timber and stone crib, with reinforced concrete wall on top. The area enclosed by these walls will be filled in and warehouses erected thereon.

The wharves proper will start from the face of the sea wall, each 500 ft. long; two will be 81 ft. wide, the middle one having a width of 118 ft., the basins between each 200 ft. in width. These wharves will be constructed of concrete cylinders, each 7 ft. in diameter, and on an average 35 ft. long. These cylinders will be placed 18½ ft. on centers. The entire superstructure will be built of reinforced concrete and steel beams; the great sheds will also be of reinforced concrete and steel —well lighted, and contain two railroad tracks each. The top of the docks will be placed at an elevation of 105 ft. from the mean sea level, and the entire area is to be dredged to an average depth of 32 ft. below mean tide level.

The Southern Pacific Railroad Co. is now constructing a tunnel under Old Fort Mason, and tracks are to be soon laid so as to connect later with the immense piers. This tunnel will be 1,828 ft. long. The dock contractors are crowding forward the work with all vigor—day and night shifts being employed.

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THE MERCHANT MARINE LEAGUE OF SEATTLE.

Elsewhere in this issue we print an article detailing the organization of the Merchant Marine League of Seattle. This action is significant of the trend of events. The people of the Pacific coast, offended by foreign domination of the western ocean, unable to develop their commerce to its fullest extent and hampered by the absurd collier policy of the navy department, have been patient and long suffering. But the end of patience has been reached and from now on the Pacific coast will demand with more effectiveness than ever before an American Merchant Marine for American commerce.

The circumstances surrounding the launching of the Merchant Marine League of Seattle are particularly auspicious. The new league has the active support of the Seattle Chamber of Commerce, the unreserved endorsement of the city's leading newspapers and numbers among its members the most powerful business men of the west.

THE MARINE REVIEW compliments the business men of Seattle for their energy and foresight in organizing for the protection of American commerce. We believe the new organization will grow and flourish and that it will be of great assistance in convincing congress of the crying need for tangible aid to American shipping.

THE IDOL WITH FEET OF CLAY.

In our August issue we referred to and quoted abstracts from correspondence between shipping interests on the Pacific coast and Acting Secretary of the Navy Beekman Winthrop.

The statements made in our criticisms of the department's action have not been and cannot be controverted. But the chamber of commerce of Seattle has taken up the subject and as the department has now another acting secretary it has also another opportunity to make itself ridiculous, of which it promptly avails itself.

In his reply to the communication from the chamber of commerce Acting Secretary W. P. Potter says:

"The department can take no other position than one of sympathy with the complaints that are made; but it must also be pointed out that its position is one of considerable embarrassment, which it sees at present no way of removing. The coals mined within Pacific coast states, as well as those from foreign countries, namely, Australia, British Columbia and Japan, are not considered by officers of the navy, who are held responsible by the department for the condition and speed of their ships, suitable for use in the furnaces of a modern ship of war. To make a comparison between the engines of such ships and those of merchant ships, even swift liners, is beside the point. While the shippers of the Pacific coast have certain interests, which the department wishes to foster instead of oppose, it must be remembered that the department is required by law to give preference to an American product; that is eastern coal."

We have before paid our respects to the platitudinous and Pecksniffian assurances of sympathy emanating from the department. The plan is deliberate and was intended to be used and is being used as a justification for the upbuilding of a fleet of colliers under the control of the navy. When naval officials profess anything else they do not speak the truth. If Mr. Potter repeats the statement regarding the unfitness of Pacific coast coal for ships of war in ignorance and upon information he is being deliberately misled and if otherwise there is a "short and ugly term" which fits the case.

We are not concerned with the coals of Australia, British Columbia and Japan; we repeat that Washington coal is perfectly satisfactory fuel for warships, especially in times of peace, and this on the authority of those who know at least as much of the subject as navy officials. They are not by any means the only authority on the subject nor even the best. We have already quoted the geological survey on the subject and there is no need to repeat it here. The citation of its use in merchant ships and swift liners is not beside the point at all; it is right to the point. Furnaces of ships of war are not different from those of others and any attempt to create a different impression is merely an effort to befog the issue. The types of boilers used in the navy are used in ships of all classes and in all services, and with the poorest coals found anywhere. The acting secretary refers to Japanese coal. Perhaps he will say next that the Japanese navy uses only Welsh or Atlantic coast coal.

He also refers to British Columbia coal. We have already pointed out that British naval vessels on that station use it. The reference to the requirements of law as to giving preference to eastern coal is deliberately misleading. It is just as applicable to Washington coal as to eastern.

If the department's position were sound our navy on the Pacific coast could not go to sea without eastern

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coal; both Winthrop's and Potter's statements are specific on that point. Fortunately for the country their statements are not the truth.

As to cost, the navy has not had a ton of coal delivered to the Pacific coast at a cost of less than $6.50 per ton, while much of it cost over $10 per ton, and while Washington coal can be had, with an efficiency only 6 per cent lower than the very best eastern coal mined, at $3.75 per ton.

The fact of the matter is that this whole coal business is not clean and will not stand the light. The department, sheltering itself behind false statements and laws distorted and misinterpreted to suit its purposes, is spending anywhere from $650,000 to $1,800,000 more per year for the 170,000 tons of coal it uses on the Pacific coast than it could do the same work for with Washington coal. Why?

In the matter of transportation THE MARINE REVIEW has gone squarely on record as opposed to the present methods of naval administration and has freely criticized the attitude of the department towards American shipping as evidenced by its openly expressed preference for that of foreigners in the transportation of coal to the Pacific coast, sheltering itself behind an emergency measure passed in 1904. For these things the REVIEW has been made the target of much criticism, which will be answered in full when the series of articles on naval administration, now appearing each month, are completed in November or December, but meantime, as evidence that the REVIEW is not alone in its attitude, we append the following abstract from an article in *Railway and Marine News*, Seattle, on the recent scandalous action of the department in connection with the transportation of eastern coal to the Pacific coast:

"How does the administration clothe itself with authority to offer American ships 50 per cent more than the rate which foreign ships offer to transport coal to this coast? Certainly the act of 1904 does not grant it. The administration has no such authority for so doing, but arbitrarily nominates that American ships cannot receive more than 50 per cent in excess of foreign ships, and this is done without investigating the motives of the owners of foreign vessels for getting their vessels to the Pacific coast during the fall of the year, when our lumber and grain business is usually at their best. Such reasoning is stupid. It is unfair and unpatriotic, and we are glad to see that all over the nation an interest in the navy is being taken—that kind of interest which will demand a curtailment of naval appropriations; which will take from the beaurocracy the great prestige it has enjoyed because of the tremendous amount of money disbursed. The curtailment should take place because the department has grown so large that it has become selfish. It cares nothing for the interests of others; provides for its own needs regardless of how much it may injure others. After that it becomes unpopular.

"*The people will resent its unfairness and a reduction in appropriations will begin.*"

The lay press, which knows nothing of the subject, and the department, which is on the defensive, may belittle the growing feeling against the navy all they choose, but facts piled on facts will not be without their effect. When all the facts about this coal deal come out there will be questions to answer a good deal more embarrassing than the historic "Where did you get it?"

LOCK VS. SEA LEVEL CANAL.

For several months past Major Jay C. Morrow, C. E., U. S. A., and Admiral C. F. Goodrich, U. S. N., have carried on a controversy over lock vs. sea level canal in the columns of the New York *Sun*. In a recent article Major Morrow referred to the editorial in the April number of THE MARINE REVIEW on "The Panama Canal and the Navigator," declaring that its perusal would convince anyone of the impractical character of the sea level type. The lucidity of that editorial is invincible. It deals with the fundamentals of ship operation in restricted and tortuous channels so clearly and accurately as to carry the conviction to any reasonable mind that the project of a sea level canal is monumental folly; for it is to be presumed that the purpose of building the canal is that ships may pass through it. It is surprising to us that the arguments advanced in that editorial have not been hitherto presented, because it is as clear as sunlight that the sea level canal, as proposed, is not a commercially navigable body of water. Apparently, however, it carries no conviction whatever to the mind of Admiral Goodrich. He dismisses it as of no value when compared with the opinions of Gustav H. Schwab and Admiral Chadwick, but chiefly we may infer because "published before the disaster at the Sault had destroyed the seaman's last shred of confidence in the safety of locks, and written by I know not whom."

The admiral may be at peace regarding the identity of the author of that editorial. THE MARINE REVIEW assumes full responsibility for it and takes some satisfaction in adding that it was written by a gentleman, not of the corps of engineers, who is better qualified by years of experience to discuss canal navigation by big ships than any officer of the navy. This is said in all modesty, because naval officers are not in position to speak with any authority on the subject, never having had, in fact, the opportunity of acquiring either knowledge or experience in this phase of navigation.

The disaster at the Sault instead of destroying the seaman's confidence in locks has done more than all the arguments that could be advanced to confirm it. The trouble is that the admiral is not familiar with the conditions at the Sault or what really occurred there. Three big ships were involved and if the stage had been deliberately set for the occasion, the conditions could not have been better chosen for achieving the maximum of damage. Yet the injury to two ships was unimportant. They proceeded on their trips and the third, after a short delay for temporary repairs, did likewise. Not a life was lost nor a man injured and the lock was in commission again in 10 days. This is the first accident that ever occurred at the Sault canal and in the 54 years of their history there have been more lockages through them than are likely to occur at Panama in a thousand years. Moreover,

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is the admiral aware that many of the great harbors of the world are nothing more than tidal basins, virtually great lock chambers in which the possibility of damage is added to and even multiplied by every ship that enters? Should the gates of these tidal basins, through some accident similar to that at the Sault, give way there might be a chaos of ships, but we do not find anyone worrying about it.

Surely Admirals Goodrich and Chadwick are not afraid that any naval ships will bring about the accident that they seem to dread. If they are, we would suggest that the authority in charge of the canal, when it shall be finished, provide a few officers who have had experience in canaling big ships and put them in charge of all vessels passing the canal.

It is almost unbelievable that any man with a thorough knowledge of the subject will recommend a sea level canal with its tidal currents, narrow bottom widths and small bottom clearance under a loaded ship; where two ships either could not pass without one making fast or else only at certain points; where the full modeled, hard-bilged cargo ship will hunt the bank with absolute certainty, although the naval ship with finer ends and easier bilges should do better; where for about half the total length the sinuous curves make steadying a ship impossible from the lack of courses or ranges even in day time, and at night a thing not to be attempted or even thought of.

The straight course of the lock canal made possible by the Gatun Lake with day and night ranges are easily negotiated at all times. Naval officers will add nothing to their reputation for ability in opposing the lock canal, even if the sea level canal would not cost over $280,000,000 more money and six years more time for construction and did not have locks of its own.

Foreigners who are not only contributing nothing to the cost of the canal but who are beneficiaries through the United States taking over their failure, have had much to say about what we should do. They were treated with far more courtesy than they had any right to expect when they were invited to take part in the consideration of the type of canal and the taste some of them have since displayed in criticising our methods is questionable to say the least; but that they should be supported by our own countrymen, who have had experience neither in building nor operating canals, is worse.

A HUMILIATING SPECTACLE.

A feature of the Hudson-Fulton celebration, and one that must have been saddening to every American as it must have gladdened the hearts of our foreign guests, was to be found in the fact that of the ranks upon ranks of sea-going merchant ships lining both banks of the noble Hudson, yes and around into the East river and Brooklyn to Bay Ridge and Bayonne, the stars and stripes waved from a solitary American liner *and she built on the Clyde.* Of river and sound steamers, coasters and tugs, lighters and ferry-boats there were not wanting hundreds, but never in the whole history of the United States has our utter impotence at sea been more forcibly demonstrated and at the moment we were celebrating in the greatest American harbor the birth of steam navigation. What a pitiable expression of a great nation, that the chief evidence of its wealth and strength and energy should be found in a fleet of battleships, cruisers, torpedo boats and submarines; implements of destruction only and as useless and valueless to us in actual war as though they still lay in the brain of the designers. Never was there nor could be a better example of the value of the merchant marine to the navy, than presented there that day. The foreign navies had more backing, right in our own harbor than our own. There lay at anchor in the Hudson a fleet of American fighting ships of which the first cost was not a cent less than $200,000,000 and only one American flag at the taffrail of a foreign-going ship in sight. If any American can consider that without shame, he is unworthy of his flag; if the fact will contribute to bringing about a better state of things the humiliation will not have been in vain; otherwise we have merely made an exhibition of ourselves, our guns and armor and ships were a vain and empty show leaving nothing but amusement and contempt with our guests, the parade had better never have been, and the picture should be draped and turned to the wall.

MUNICIPAL HARBOR IMPROVEMENTS.

The investigations necessary in the preparation of the series of articles now appearing in THE MARINE REVIEW describing the principal harbors of the north Pacific coast may have led incidentally to the collection of considerable data on the general subject of municipal harbor improvements, both on the Pacific coast and on the Atlantic. A study of this data leads to a number of interesting questions, three of the more important of which may be stated as follows:

1. How far may a corporate city or port district legitimately go in the improvement of its harbor facilities? That it should provide a deep, easily navigable and well protected fairway from its water front to the open sea cannot be questioned. A seaport without a deep, well protected, accessible harbor is dead. But after the harbor itself has been improved, in which work the city can often obtain assistance from the national government, how far may the municipality go in providing the wharves, piers, dry docks, coal bunkers and even ship yards which are necessary to every well-appointed harbor?

2. What kind of an organization is most suitable for the economical management of public harbor improvements?

3. To what extent is the expenditure of money on harbor improvements justified by the increased shipping and commerce attracted by these improvements? These are questions of vital importance to every American seaport city.

It is not the function of the munici-

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pality to do by public effort what can just as well and probably more efficiently be done by private enterprise. Private enterprise cannot dredge a channel and charge toll for using it, so dredging becomes properly a function of the municipality. In this class also falls the construction of sea walls for protecting the harbor from storms or its shores from erosion.

A few cities have built dry docks, notably Portland, Ore. The Portland dock was built at a time when private capital would not venture into such a costly proposition. It has undoubtedly been of great assistance in placing the marine repair firms of the city in a strong position and has held considerable shipping at Portland that would have otherwise been diverted to Puget Sound. But the operation of a dry dock is naturally a private enterprise and to obtain the best results the dock should be operated in close sympathy with an adequately equipped marine repair shop. The city cannot, without flagrantly violating the principles of individual effort, operate a marine repair shop. It must content itself with leasing the dock to firms that have the necessary tools and equipment for repairing vessels. The shops of these firms are at some distance from the dock. The result is an actual waste of physical effort and a lack of proper co-ordination in the work of repairing vessels in the public dock. Except under exceptional circumstances such as have existed at Portland in the past, it is unnecessary and unwise for the city to own drydocks. An examination will show that those cities that have left their drydock business to the enterprise of private citizens have in no way suffered through the lack of proper docking facilities. Even at Portland, which maintains a large public dock, a privately-owned dock is in the process of construction.

The municipal ownership of piers and wharves where vessels may land to load and unload freight and passengers is a different question from the public ownership of dry docking and marine repair facilities.

The sea, to all intents and purposes, is merely a road leading from port to port. The piers and wharves, viewed in this light, are merely gates through which this great road leads to the city and the land beyond. The immense public value of these landing facilities is easily appreciated. The finest steamship in the world is practically worthless without landings. It is the duty of the public to be sure that its landing facilities are adequate and also open to the free use of any ship willing to pay a reasonable dockage. This dockage charge should be as low as is consistently possible and should be absolutely the same to all comers. The public nature of these facilities is such that it is logical that a good per cent of the wharves in any city be controlled by the municipality. It is not necessary that the city operate the piers, in fact it has been found expedient to lease their operation, under suitable restrictions as to rates and the extension of equal privileges to all, to private parties.

All the great seaports of the world have large investments in water front property, wharves, piers and harbor cranes for handling heavy freight. Among these cities may be named New York, Baltimore, New Orleans, San Francisco, London, Liverpool, Glasgow, Hamburg, Bremen, etc. New York city has spent $50,000,000 on its wharves, piers and harbor improvements. The city owns 48 miles of water-front out of a total of 445 miles. Baltimore has under construction a number of piers ranging in length from 400 to 1,400 ft. On the Pacific coast San Francisco and Portland have done the most in harbor improvements.

Having now outlined the kind of harbor improvements in which it is wise and necessary for a city to invest we arrive at the question of how this great work can be best administered. The work is of an economic and engineering nature and should certainly be divorced from all taint of politics. The universal experience of all cities engaged in extensive harbor work has shown that the best way to do this is to vest the necessary authority in an independent, non-partisan harbor board or port commission. The Port of Portland organization, which was fully described in the May MARINE REVIEW, is one of the most highly developed in this country. The board is composed of seven members chosen from among the prominent shipping, commercial and engineering interests of the city. These men serve without compensation and hold office practically for life. The results achieved at Portland and also at other ports entitle this form of organization to the highest commendation. The port commission not only gives the harbor work an economical and businesslike administration, but it insures a unity in the design and execution of the harbor improvements, without which the usefulness of the work done is greatly impaired.

The policy of vigorously prosecuting such harbor work as legitimately falls to the muinicipality to do, is one that experience has shown is accompanied with the greatest possible benefits. The city should aim to keep its harbor facilities actually ahead of the times and these facilities will draw shipping, create trade and develop business just as surely as a magnet attracts its armature. If the municipality will do its part of the work, with this as an assured foundation, private capital can be depended upon to do the rest. The great significance of these truths is scarcely appreciated by the majority of American cities, who are content to let their harbor facilities grow as best they may without direction or assistance and in a haphazard fashion utterly inconsistent with proper commercial demands or possibilities.

We cannot do better at this point than to quote the words of the harbor board of Montreal, Can., which conclusions were written after a searching investigation of the value of municipal harbor improvements:

"The ports that are doing the biggest business and doing it most efficiently are the ports that have kept their facilities *ahead of actual requirements.*

"The ports that have remained stationary or lost in prestige have been those who neglected to provide facilities before business was forced to seek elsewhere the same facilities provided by rival terminals. Business follows the facilities.

"Unity of authority, concentration of business, depth of water areas and facilities for despatch of business are the

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prominent characteristics of successful port administration.

"There is necessity for providing large and convenient storage areas where cargo may be collected and cared for.

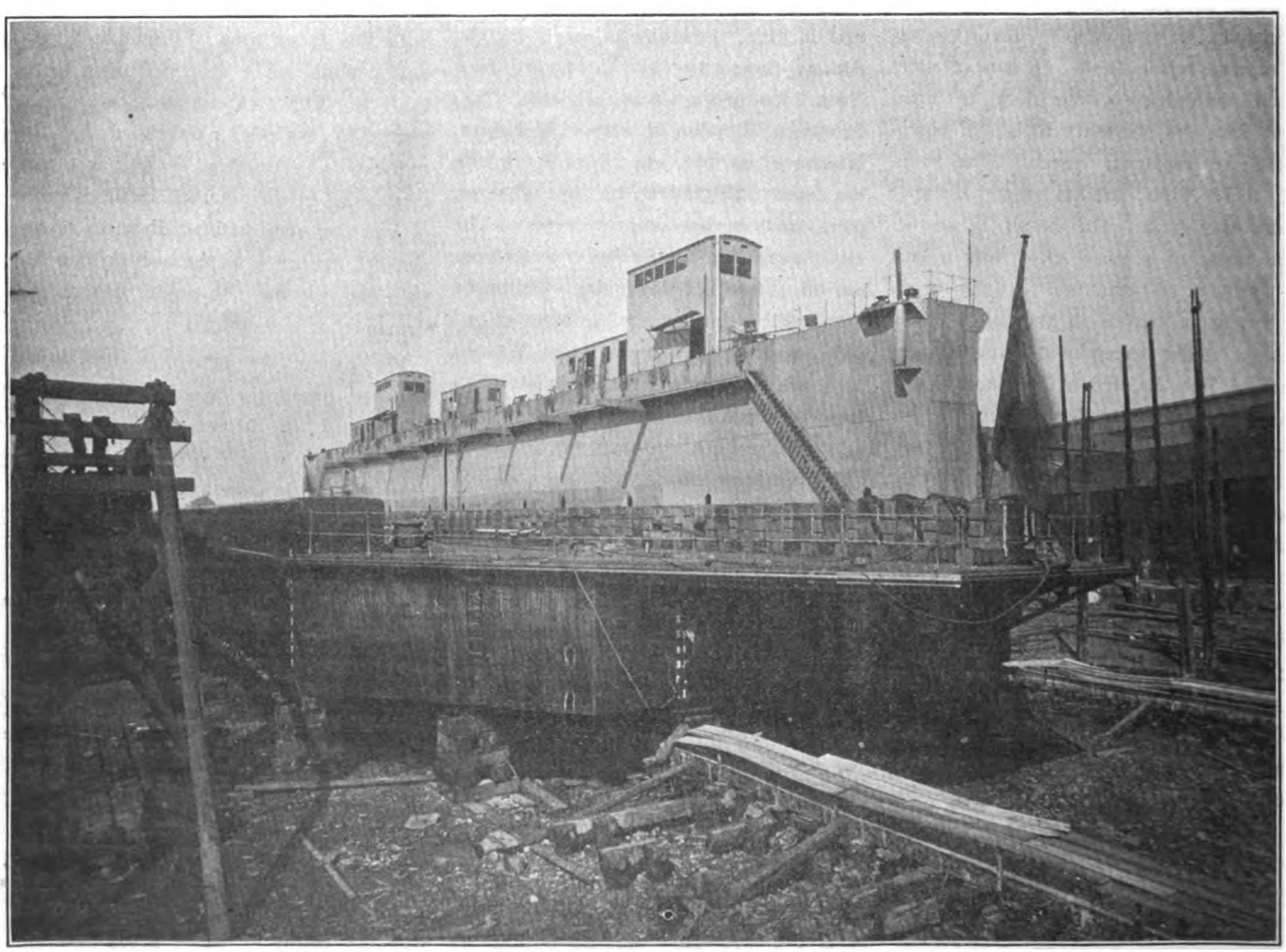
"The lowest cost of handling cargo from the hold of the ship to the consignee and vice versa was found to be in a port where one authority controls the entire operation and where the transit sheds were three to five stories high.

"Great port developments have invariably been followed by increase of trade and population."

Is it not time for our American cities to wake up and tackle this problem? New York, Baltimore and Portland, Ore., have begun in the right direction. It is to be hoped that scores of other American ports will soon appreciate the magnitude of the task before them, a task which must be performed if they are to hold their share of the sea-going and coastwise commerce of this nation.

New Floating Dock for Penarth Roads

A FLOATING dock which has been constructed to the order of the Penarth Ship Building & Repairing Co., by Messrs. Swan Hunter & Wigham Richardson, Ltd., is here illustrated, one view showing the dock before launching, while the other two show firstly the dock afloat, and secondly the complete dock assembled. The dock, it will be seen, is of the off-shore or single-walled type, and was designed by Messrs. Clark & Standfield, London. It has an overall length of about 380 ft., an extreme width of 75 ft., and is capable of accommodating vessels having a beam of 55 ft. with a draught of water up to 18 ft. and a displacement of 4,200 tons. As the term off-shore implies, the dock is attached to the shore by means of booms which are hinged and pivoted at the dock, and also at the shore ends to permit of the lowering and raising of the dock when vessels are being docked or undocked. Two very powerful sets of pumping machinery are supplied to the dock, consisting of four centrifugal pumps and engines manufactured by Messrs. Gwynnes, Ltd., of London. Steam is supplied by two large Babcock & Wilcock boilers working at 160 lb. pressure. The plant is capable of lifting a vessel of 7,000 tons d. w. in the remarkably short time of three-quarters of an hour. For the purpose of self docking, the dock is divided transversely into two equal halves each with its own pumping plant, so that any one section can be docked by the remaining portion, one half being lifted so to speak in the lap of the other. A powerful steam capstan is fitted at each end of the top wall to assist in working vessels into position when lifting or otherwise. Light, mechanical side shores are supplied, in addition to the usual accessories for facilitating the



THE PENARTH DOCK BEFORE LAUNCHING.

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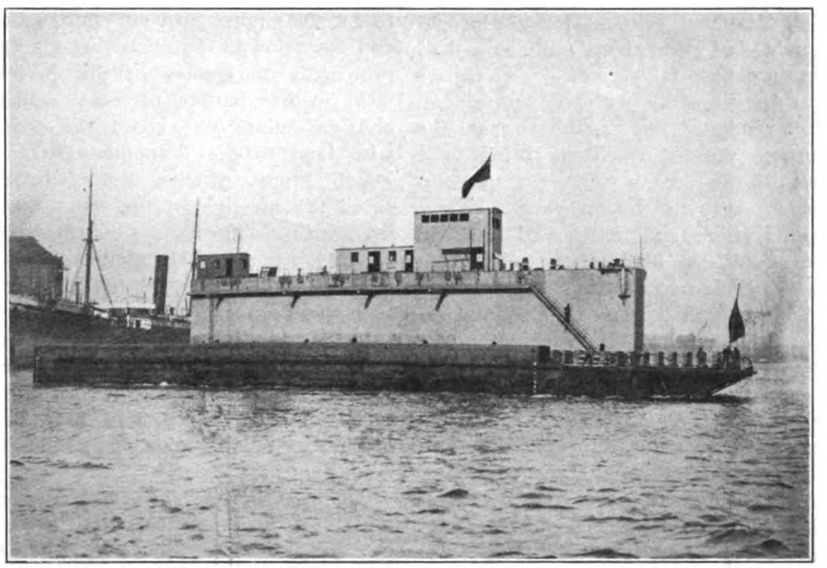
rapid handling of vessels during the operation of docking and undocking, such as bilge shores, roller fenders, rubbing timbers and bollards. A duplex reciprocating pump with a capacity of 100 tons per hour, has been provided. This pump has a connection to a main drain of the dock, which will enable the last drops of water to be pumped out of the dock. There is also a connection to the sea. On the delivery side the pump is connected to a service pipe which has connections at intervals for 3-inch delivery hose. The pump is capable of throwing three jets of water to a height of 40 ft. to enable the floating dock to enter the wet dock in which it is destined to work, the entrance to which is several feet less than the width of the dock, there is a longitudinal joint running the whole length of the pontoon. When the dock arrived in Penarth Roads, this joint was disconnected and the separate sections towed into the wet dock, and thereafter reconnected, and the attachment to the quay wall completed.



SHOWING ONE-HALF OF THE PENARTH DOCK.

This dock is another good example of the skill of the renowned floating dock builders, Messrs. Swan Hunter & Wigham Richardson of Wallsend-on-Tyne. They have built floating docks of every type, whether for the British Admiralty or for foreign or colonial governments, or for private companies in every quarter of the globe. Last year alone, they built and dispatched no fewer than five floating docks, one of them was the famous 7,000 ton dock for Callao in Peru, necessitating a towage of 11,000 miles, including the very hazardous passage of the Magellan straits.

NEW FERRY FOR VANCOUVER, B. C.

For service across Burrard inlet between the cities of Vancouver and North Vancouver, a distance of 2 miles, the North Vancouver City Ferries, Ltd., is building a new, modern ferry boat. The company already operates an extensive ferry service, and the new vessel is to provide additional facilities to take care of increased business.

The principal dimensions of the hull of the new ferry, which is to be double ended and built of steel with six watertight compartments, are as follows: Length over all, 165 ft.; length of keel, 145 ft.; molded beam, 28 ft.; beam over guards, 44 ft.

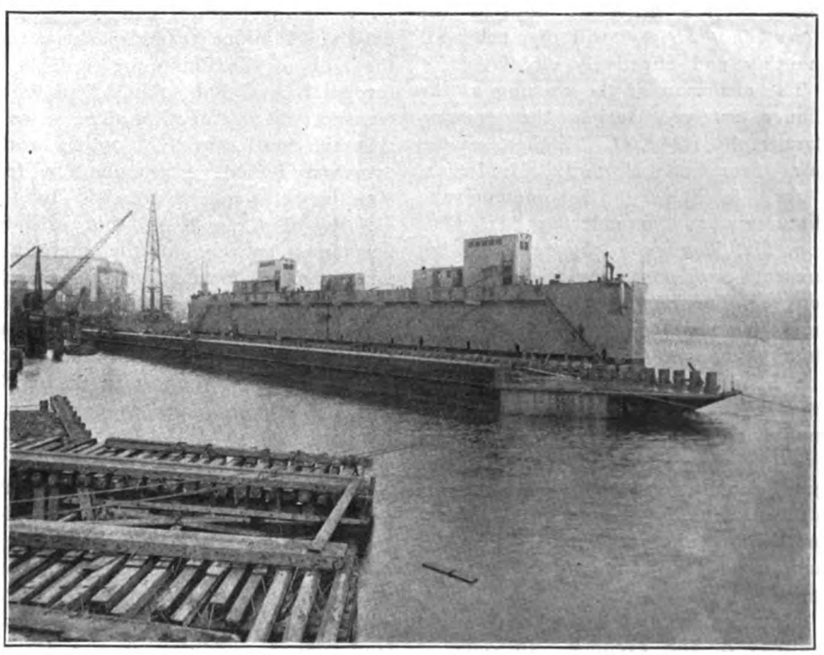
There will be a propeller at each end, the two driven by a triple-expansion engine, 14, 22 and 38 in. in diameter by 20-in. stroke. Steam is furnished by two Babcock & Wilcox water-tube boilers carrying a working pressure of 200 lb. per sq. in. The speed of the boat is to be 12 knots per hour. Each boiler has sufficient capacity to drive the boat 9 knots, when fired alone. The machinery is to be copper piped and brass fitted.

The auxiliaries include hand and steam steering gear, electric lights and independent pumps for all purposes.

The forward hold will be fitted up for a cafe and lunch counter, provision for the crew's quarters will be made in the after hold.

Two driveways for teams, each 9 ft. wide, will be provided on the main deck. Outside of the driveways will be the smoking room, fruit stand, shoe blacking stand, etc.

The main cabin on the passenger deck will be enclosed with glass and the cabin itself provided with upholstered seats and rubber tile floor. The finish of the cabin is to be in rosewood.



SHOWING THE PENARTH DOCK IN COMPLETED STATE.

On the hurricane deck above the cabin will be two pilot houses, one at each end and also the captain's cabin. Each pilot house will be fitted with a 40-ampere electric search light. The cabins will be constructed of Pacific coast fir and cedar.

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Merchant Marine League of Seattle

AT A dinner given by the trustees of the Seattle Chamber of Commerce, Wednesday evening, Sept. 8, in honor of John A. Penton, secretary of the Merchant Marine League of Cleveland, O., the Merchant Marine League of Seattle was organized. Among the charter members of the new league are those men who are most prominently identified with the commercial development of the Pacific northwest. After a careful review of the situation, realizing fully the desperate condition to which the American merchant marine has been brought and appreciating thoroughly the necessity for immediate action on the part of the government which shall insure the rehabilitation of our maritime commerce, these substantial business men of the Pacific coast have created a league dedicated to the upbuilding of American shipping. The new organization will work along much the same lines as those pursued by the older league with which it will closely co-operate. It will arouse public opinion and weld public sentiment together into an effective working force; a magazine entitled the *Stars and Stripes* will be published monthly and effectively circulated.

The chairman of the evening at the dinner referred to in the opening paragraph was E. C. Hughes, of the law firm of Hughes, McMicken, Dovell & Ramsey. In opening the discussion and introducing Mr. Penton, Mr. Hughes briefly reviewed the present condition in American shipping on the Pacific. He pointed out how Japanese commerce is rapidly dominating the western ocean, how the British and German vessels monopolize the wheat traffic of the Columbia river and showed that when the Panama canal is finished there is great danger of there being no American ships to use it. Mr. Hughes' remarks formed a splendid background and introduction for the more detailed addresses which followed.

Mr. Penton delivered the principal address of the evening. In opening he complimented the business men of Seattle for their deep interest in the merchant marine question, which he declared will soon become an issue of predominating national importance.

He detailed in a careful and thorough manner the history and accomplishments of the Merchant Marine League of Cleveland. He pointed out how at first practically every newspaper in the country was opposed to the Merchant Marine League propaganda, but now there are not a half dozen influential periodicals which are not in sympathy with the movement. He reminded his auditors that the foreign vessels which are being built out of the profits of American commerce are all constructed to naval specifications and in time of war will be used as auxiliaries to foreign navies. In conclusion Mr. Penton paid a warm tribute to Congressman W. E. Humphrey, of Washington, for his valuable service in behalf of the American merchant marine and complimented the people of Washington for their splendid representative.

Congressman Humphrey followed Mr. Penton with a very able address detailing the present deplorable condition of American shipping. He showed how we are paying millions of dollars annually to upbuild foreign naval power; he pointed out that the foreign trade of the United States amounts to $3,000,000,000 annually, only 5 per cent of which is carried in American bottoms, that Samoa, a U. S. naval station, can be reached only via foreign steamship lines, that the bulk of the Philippine trade is in foreign hands, that soldiers had to be transported to Cuba in alien vessels, that the battleship fleet on its world tour was coaled and supplied by foreign vessels and that while in the vicinity of Cape Horn this splendid fleet was entirely at the mercy of European governments. Taking up the subject of freight rates, Mr. Humphrey declared that the rates between the United States and South America are the highest in the world and are twice as high as corresponding rates from European ports; he called attention to the recent rise of 30 per cent in trans-Atlantic freights and to an increase in wheat rates between the Pacific coast and Europe of over four fold due to the action of the foreign shipping combine. Japan with her auxiliary transports could land 200,000 soldiers in the Philippines and 20,000 in Hawaii, while the United States was embarking 10,000. Japan has 560 available transports on the Pacific ocean; the United States has ten. "Is it worth more to the foreigners to keep our flag off than it is for us to keep it on the ocean?" concluded Mr. Humphrey.

H. R. Clise, of Seattle, gave the reasons for the depression in Pacific coast shipping. He stated the causes to be the higher cost of construction and operation of American vessels and principally the policy of the government in its charters of naval colliers and its failure to extend the coastwise laws to the Philippines.

Col. Pippy, of San Francisco, assured the meeting of the great interest which California has in this matter and promised the practically united support of the California delegation in congress.

Ex-Senator John L. Wilson warned the league to keep busy and not trust too much to congress. "America," he said, "is a mere outpost, a British or German colony, so far as commerce is concerned."

Upon motion of Mr. Clise, a committee of five was appointed to report on a constitution and nominate officers for the Merchant Marine League of Seattle.

The committee reported shortly and the following officers were elected: President, E. C. Hughes; vice presidents, Hon. John H. McGraw, J. W. Clise and F. W. Baker; treasurer, Wm. Calhoun; secretary, J. P. Parkinson; executive committee, Hon. John L. Wilson, D. H. Jarvis, I. A. Nadeau, C. J. Smith, G. F. Thorndyke, J. D. Lowman, James S. Gibson, C. E. Fowler, H. R. Clise and J. V. Paterson.

George F. Thorndyke, manager of the Globe Navigation Co., of Seattle, has pioneered the merchant marine work on the north Pacific coast and it is largely through his efforts that the Seattle league was organized.

According to rumors at the Puget Sound navy yard, the United States government is considering the purchase of the British steamer Belle of Scotland, now laying at Union bay. The Belle of Scotland left Newport News on June 23 last with 6,320 tons of coal for the United States naval station at Bremerton, at which place she arrived on Sept. 5.

The new steamer built at Walker on Tyne for the Donald Steamship Co., of New York, has been named Querida and will carry 2,000 tons dead weight. The Querida sailed from Shields Sept. 26, bound to Sydney, C. B. She will engage in trade between Canadian and United States ports.

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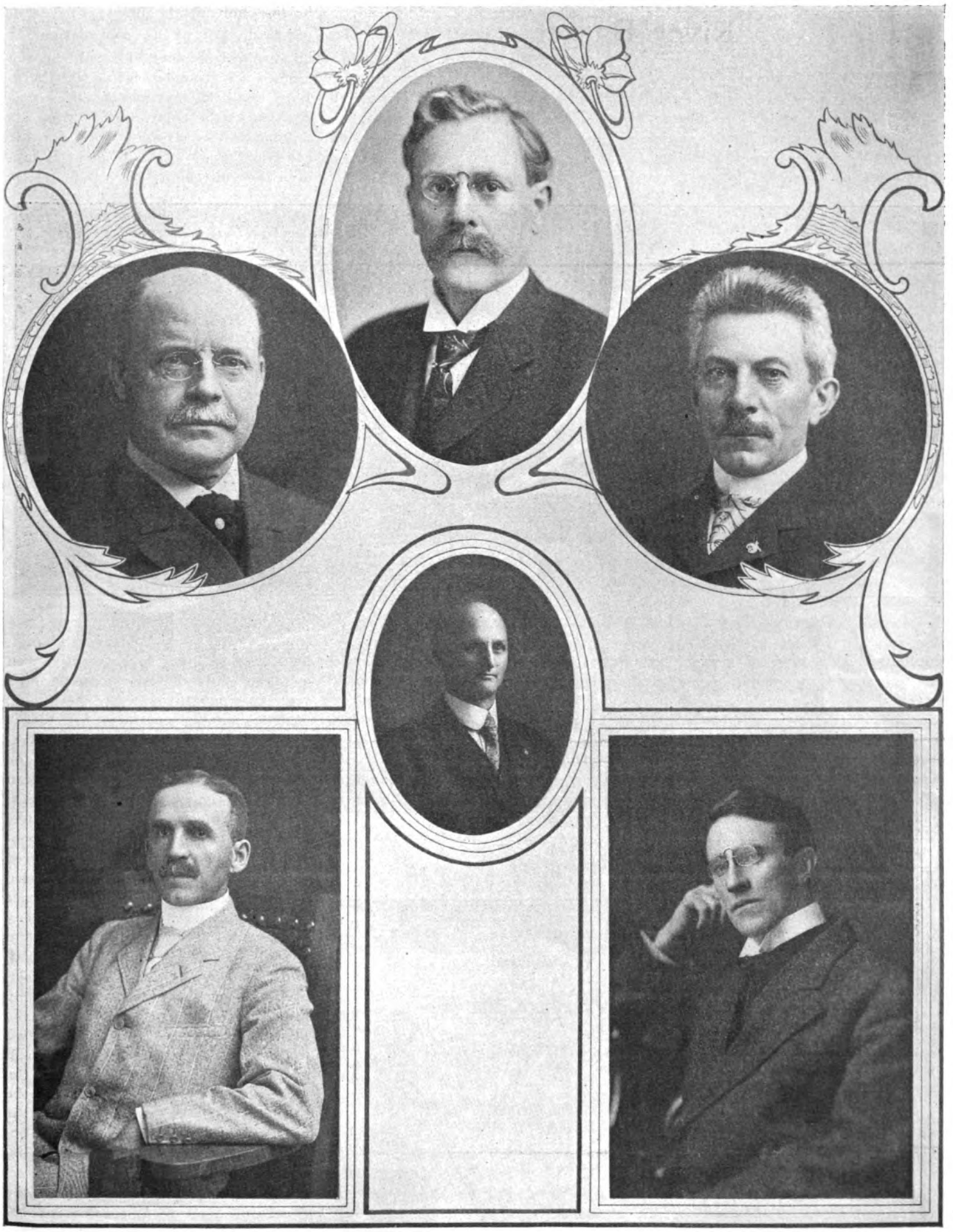
Officers of Merchant Marine League of Seattle



E. C. HUGHES.
PRESIDENT OF THE MERCHANT MARINE LEAGUE OF SEATTLE.

JOHN H. McGRAW
VICE PRESIDENT.

F. W. BAKER
VICE PRESIDENT.

J. W. CLISE
VICE PRESIDENT.

WILLIAM CALHOUN.
TREASURER.

J. P. PARKINSON
SECRETARY.

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Recent Development of the All-Steel River Barge

COMMERCIAL developments of recent years have firmly established a place for the all-steel barge in river and inland steam transportation in the United States. The growth into favor of this auxiliary type of carrier has been comparatively rapid, extending over a period of probably not more than six or seven years. Today the steel barge by reason of its durability and length of service, ultimate economy of construction cost and general adaptability, is being extensively used by important industrial and transportation companies and its field is expanding. These barges are used for transporting coal, oil, sand and other bulk commodities, for ferrying railroad trains, for service at government dams and locks and in numerous other transportation enterprises. On general lines the boats are built of steel plates ranging from ¼ to ⅜-in. in thickness and of standard structural shapes of various sizes and weights.

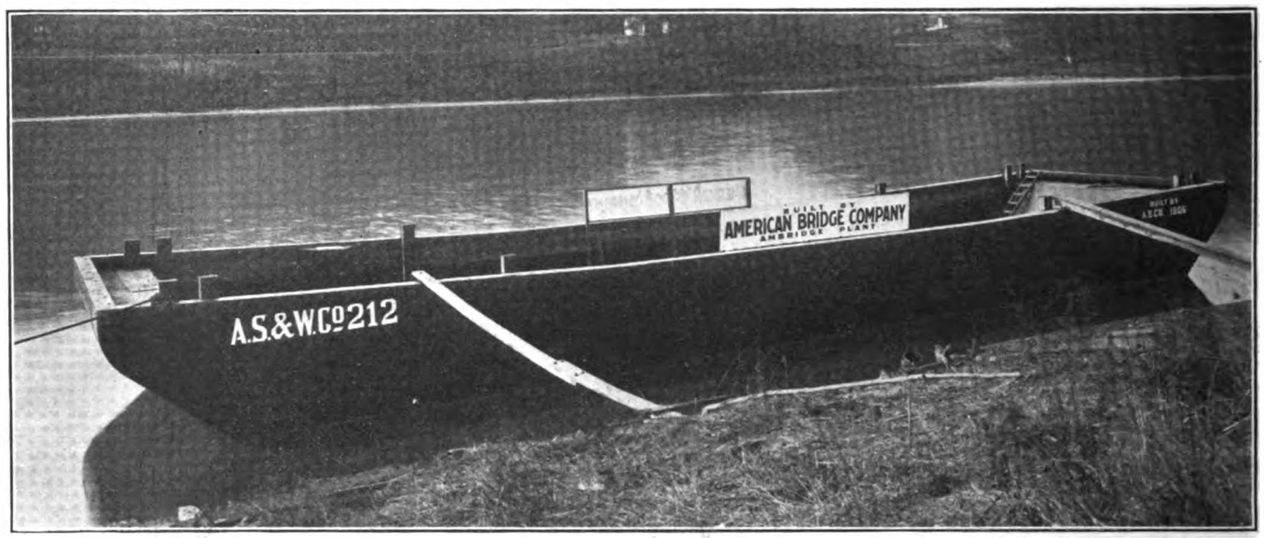

FIG. 1—COAL BARGE BUILT FOR AMERICAN STEEL & WIRE CO.

The American Bridge Co. has been an important factor in the development of the steel barge in river traffic, having built nearly 100 of this craft, practically all of its own design, at its Ambridge plant, located on the Ohio river 16 miles below Pittsburg. Ever since the erection of this extensive works the company has given attention to this class of work, for the construction of which its plant is favored by an admirable location. Its launching facilities have recently been increased through the extension of its ways to a length of nearly 600 ft.

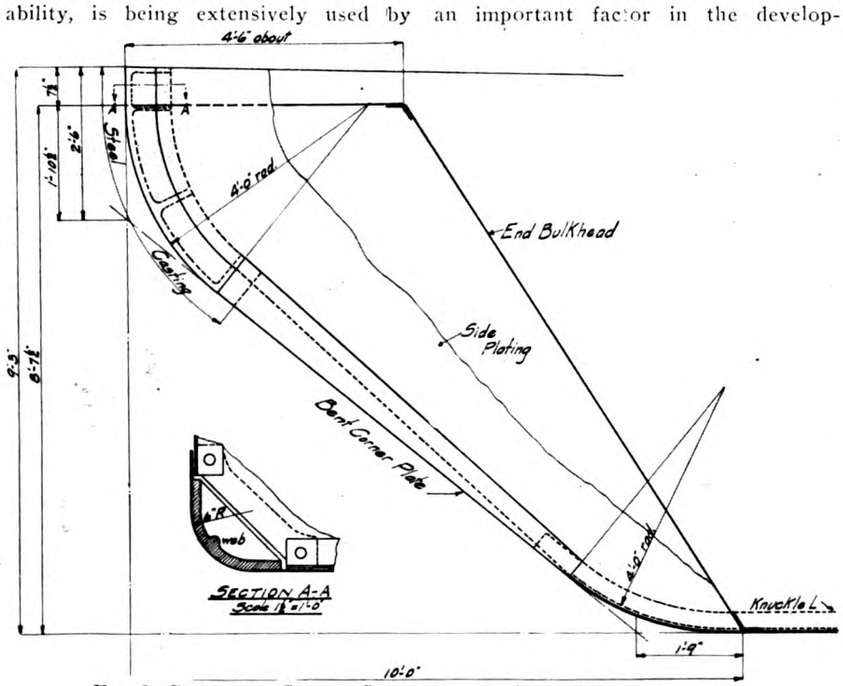

FIG. 2—BILGE AND CORNER CONSTRUCTION, A. S. & W. CO. BARGES.

Some notable contracts for barges designed for varied service have recently been taken or filled by the American Bridge Co. The American Steel & Wire Co. is an important instance of the adoption of the steel barge by large manufacturing corporations. This comppany has ordered a fleet of 10 boats which will be used in bringing coal to the Shoenberger works located along the Allegheny river at Pittsburg and to the Rankin and Braddock works along the Monongahela river in the same district. Steel billets also are transferred by the barges from the steel plant at the Shoenberger works to the other two mills. The additional 10 barges will give the American Steel & Wire Co. a fleet of 30 boats all built by the American Bridge Co. As fast as the old wooden barges of the company become unserviceable they are being discarded and replaced by the steel type. The new barges now building for the American Steel & Wire Co. are 100 ft. long, 24 ft. beam and 8 ft. deep and the capacity is 400 tons each. They are designed with water tight end compartments as shown in Fig. 1, and have a 3-in. oak floor. The boats have

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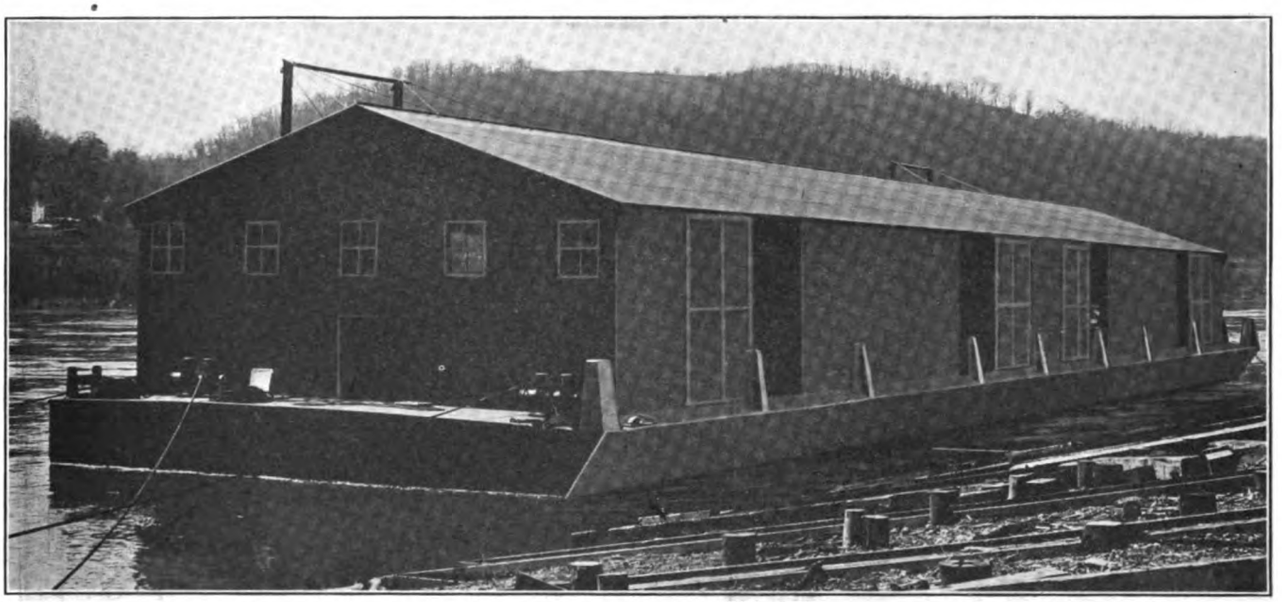

FIG. 3—ALL-STEEL WHARF BOAT BUILT FOR THE CONSOLIDATED WHARF CO., OF MEMPHIS, TENN.

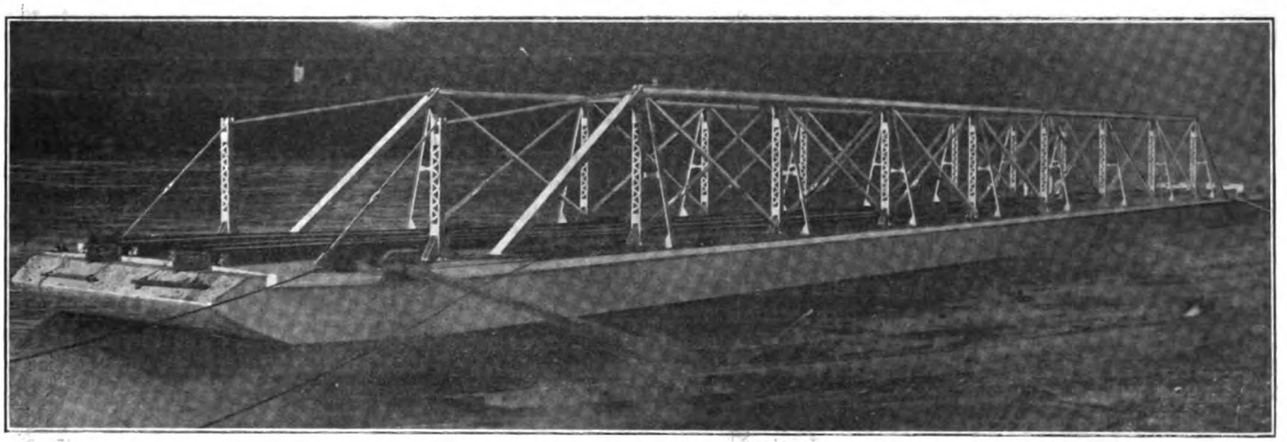

FIG. 5—TRANSFER BOAT FOR LOUISIANA RAILWAY & NAVIGATION CO.

FIG. 6—TRANSFER BARGE FOR J. W. THOMPSON, ST. LOUIS.

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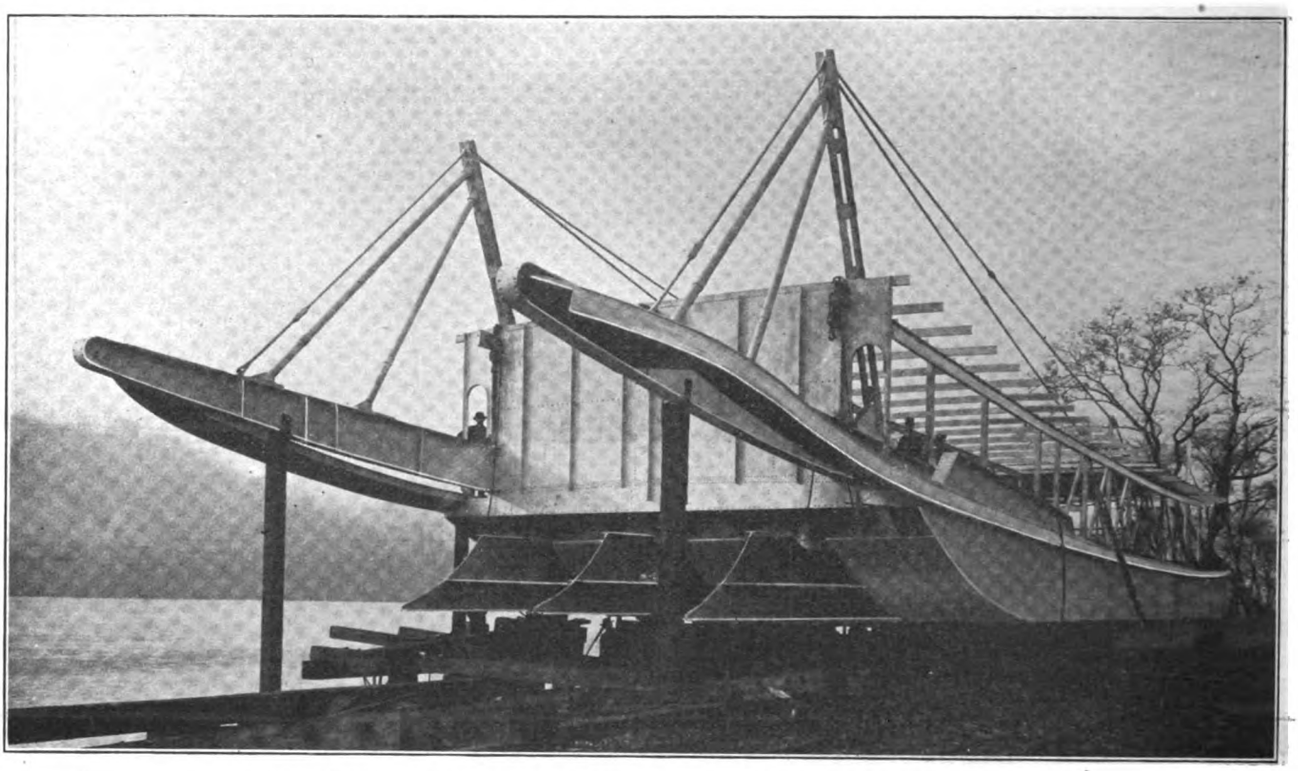

FIG. 4—STERN OF TOWBOAT FOR LOUISIANA RAILWAY & NAVIGATION CO.

square bilges equipped with the American Bridge Co. patent rounded steel corners which are formed by a combination of steel castings and rolled plate as shown in Fig. 2.

The company has also lately built a unique form of river vessel in an all-steel wharf boat of 220 ft. length, 48 ft. beam and 6 ft. depth for the Consolidated Wharf Co. of Memphis, Tenn., which is the only craft of its type on the inland river traffic. The vessel, shown in Fig. 3, has a cargo shed 200 ft. long, 43 ft. 6 in. wide, and 14 ft. high framed of steel and covered with galvanized corrugated sheeting. It is also provided with two steel landing stages 40 ft. long each, having a 10 ft. roadway and a 3 ft. sidewalk. A tow boat 145 ft. long with steel rudders and simple stern construction, shown in Fig. 4 as well as a transfer boat 295 ft. long by 37 ft. beam by 7 ft. depth, Fig. 5 have been designed and built for the Louisiana Railway & Navigation Co. The transfer boat carries double tracks with a capacity of 14 cars of 100,000 pounds each on a 5 ft. draught. It has scow bow and stern and pin-connected stiffening trusses 15 ft. deep. There are water tight transverse bulk heads. The boat was built on the American Bridge Co. design in accordance with suggestions by Captain William McClellan. Among the most recent transfer barges built are two of 14-car capacity for J. W. Thompson of St. Louis for use on the lower Mississippi river. Each are 244 ft. 6 in. long, 40 ft. beam and 7 ft. deep. As shown by Fig. 6, they are designed with a scow bow and a 9 ft. riveted box section truss. Each has three tracks with switches and cross-overs to accommodate a double-track landing stage.

The American Bridge Co. at present has under construction and will soon have on the ways three bulk oil barges which will be used on the lower Mississippi by the Teche Transportation & Fuel Oil Co. These boats were designed by Matteson & Drake, marine architects, New York. They are 125 ft. long, 30 ft. beam and 6 ft. 4 in. deep and each will be constructed with six oil-tight compartments with expansion trunks over each tank and each barge is fitted with two pumps.

A SUPER "INVINCIBLE" BRITISH CRUISER.

Extraordinary precautions are being taken to keep secret the details of the design of the mammoth cruiser to be built at Devonport, but, from what has already been communicated to the dockyard officials there, it is apparent that she will be of much greater displacement and speed than the indefatigable, the cruiser which, up to the present, has represented high-water mark. The new vessel is credited with a speed of nearly 30 knots. Her length, it is believed, will approach 600 feet, and the main armament, on the all-big-gun principle, will consist of an increased number of 12-inch guns in association with a more powerful anti-torpedo armament. The torpedo equipment will consist of the new 20-inch weapons, with an effective range of 7,000 yards. It is believed that this ship will be the first of a group of four similar single-masted cruisers, and that provision for the remainder will be made in the estimates for the next financial year. The Devonport vessel will be built rapidly, as in the case of the first Dreadnought.

The new seven-pocket mud scow recently launched at Baltimore, has been sold by William E. Woodall & Co. to the Maryland Dredging & Contracting Co. The new scow is 127 ft. long, 34 ft. beam, and 12 ft. deep with a carrying capacity for 1,000 cu. yds. of excavated earth.

Each of the five large navy yards on the Atlantic coast will have a battleship under reconstruction when work is begun on the Illinois, Alabama, Kentucky, Maine, and Kearsarge. These improvements will entail expenditures of about $600,000 on each.

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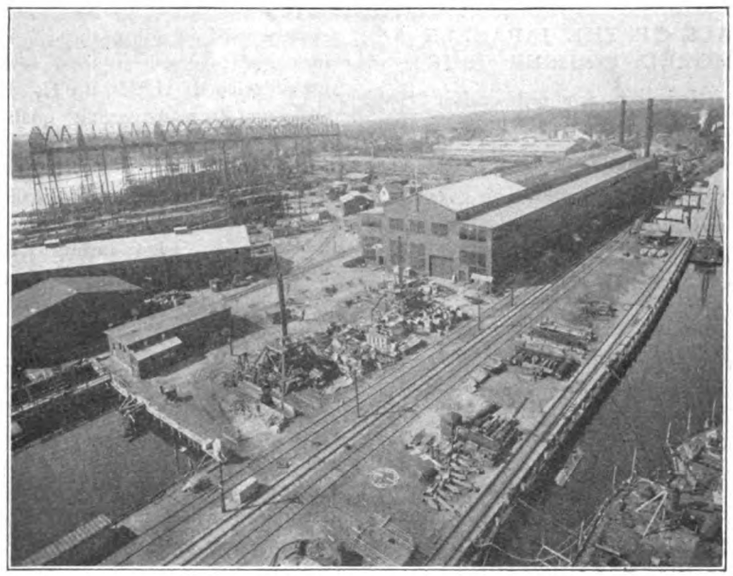


GENERAL VIEW OF THE PLANT OF THE FORE RIVER YARD.

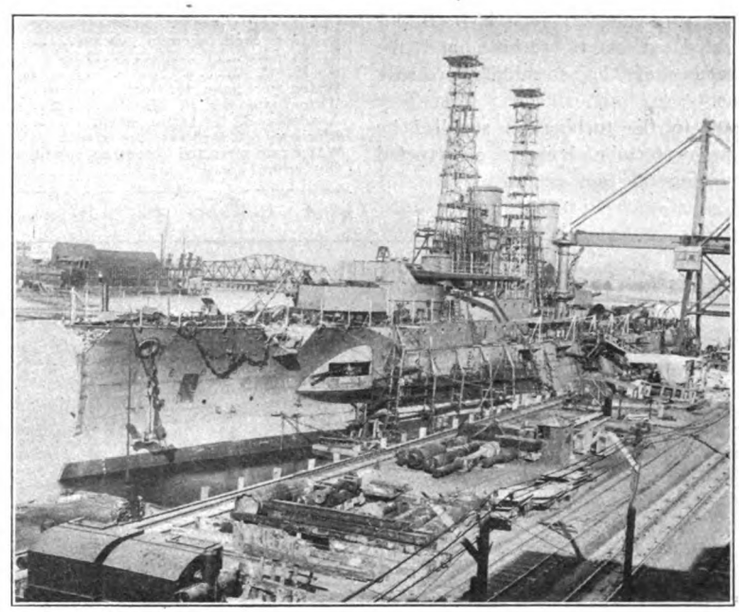
VIEW OF FORE RIVER YARD.

The view published herewith, of the yard of the Fore River Ship Building Co., Quincy, Mass., is taken from the forward battle mast of the North Dakota and shows the whole yard with the exception of the copper shop and offices of the Electric Boat Co. The vessels under construction on the slip way beginning with the lower boat, are: Yacht for Commodore James; U. S. torpedo boat destroyer Perkins; U. S. torpedo boat destroyer Sterrett; molasses barge Fifi; molasses barge Graziela; ammunition lighter No. 13; sulphur boat Herman Frasch; molasses lighter Micuelito.

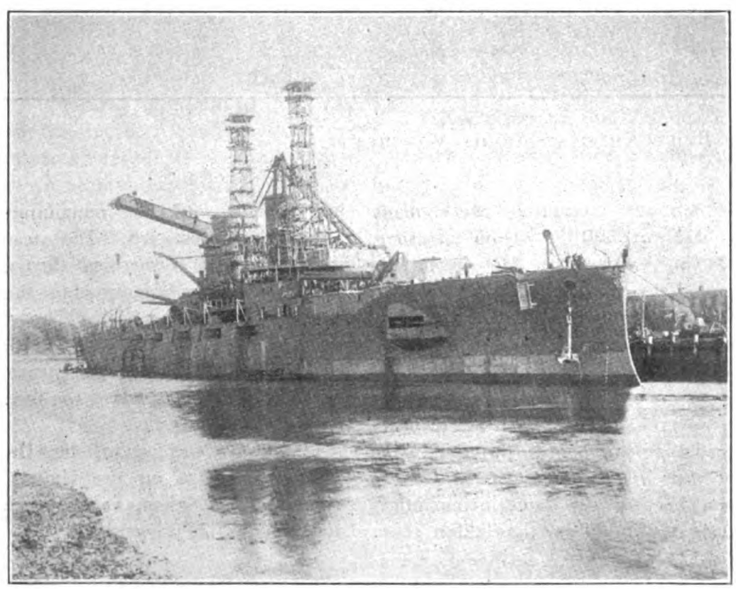
The picture does not show the 100-ton gantry crane which at that time was being employed installing casement armor on the North Dakota.

BATTLESHIP NORTH DAKOTA.

The Fore River Ship Building Co., Quincy, Mass., report the battleship North Dakota as 95.2 per cent completed on Oct. 1. The North Dakota will leave the Fore River yard on Wednesday, Oct. 27, and will proceed to Provincetown where a few runs will be made over the measured mile. On the following day the vessel will be docked in the navy yard at Boston, and the bottom cleaned and painted, after which she will go to Rockland, Me., where the standardization trials will be made on Nov. 2, to be followed shortly thereafter by the steam and endurance runs required by the contractor. It is hoped that the vessel will be completed and delivered to the government within the current year.



BATTLESHIP NORTH DAKOTA, SHOWING HER 95.2 PER CENT COMPLETED.



BATTLESHIP NORTH DAKOTA, SHOWING HER 95.2 PER CENT COMPLETED.

OPEN SHOP ON THE PORTLAND WATERFRONT.

The three big Portland grain shipping houses of Kerr, Gifford & Co., Balfour, Guthrie & Co. and the Portland Flouring Mills Co., on Aug. 13, put into effect a sweeping order declaring an open shop on all grain-handling work at their various docks on a flat wage scale of $3 for a 10-hour day. The action marks the crisis of a struggle that has been brewing between the shippers and the grain handlers' union since last April. A stubborn fight is anticipated and as a result, open shop at Portland. Some of the fall grain shipments may be diverted to Puget Sound.

It is estimated that 250 sailing ships will be required to export the Washington and Oregon wheat crop this year. About 50 of these vessels have already been chartered.

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CLYDE-BUILT AMERICAN YACHT.

The fast steam yacht Winchester, constructed for an American owner by Messrs. Yarrow of Glasgow, passed her trials last week in the Firth of the Clyde, and will leave Glasgow for New York in the course of a few days. She will be towed across the Atlantic.

She is built on torpedo boat lines, and her dimensions are as follows: Length, 165 feet; beam, 15 feet 6 inches.

Her estimated speed was 26 knots, and the mean speed obtained on a two hours trial was 26.7 knots.

The propelling machinery consists of three turbines of Parsons' type (constructed by Messrs. Yarrow) with three shafts, one propeller on each shaft. The port shaft is actuated by a high pressure turbine, the center shaft by a low pressure turbine in which is incorporated an astern turbine, and the starboard shaft by a middle pressure turbine.

Steam to the turbines is supplied by Yarrow watertube boilers, constructed for burning oil fuel exclusively.

TRIALS OF THE JAPANESE ARMORED CRUISER IBUKI.

The Japanese armored cruiser Ibuki has recently completed a series of very successful steaming trials at the Kure navy yard in Japan. This vessel is equipped with Curtis marine reversible turbines built by the Fore River Ship Building Co., of Quincy, Mass., U. S. A., which were shipped to Japan and installed in the vessel at the Kure yard.

The turbines drive twin screws, are of 12 ft. pitch diameter, 7-stage type, and were guaranteed to deliver 21,600 B. H. P.

The following table gives the results obtained on the various trials:

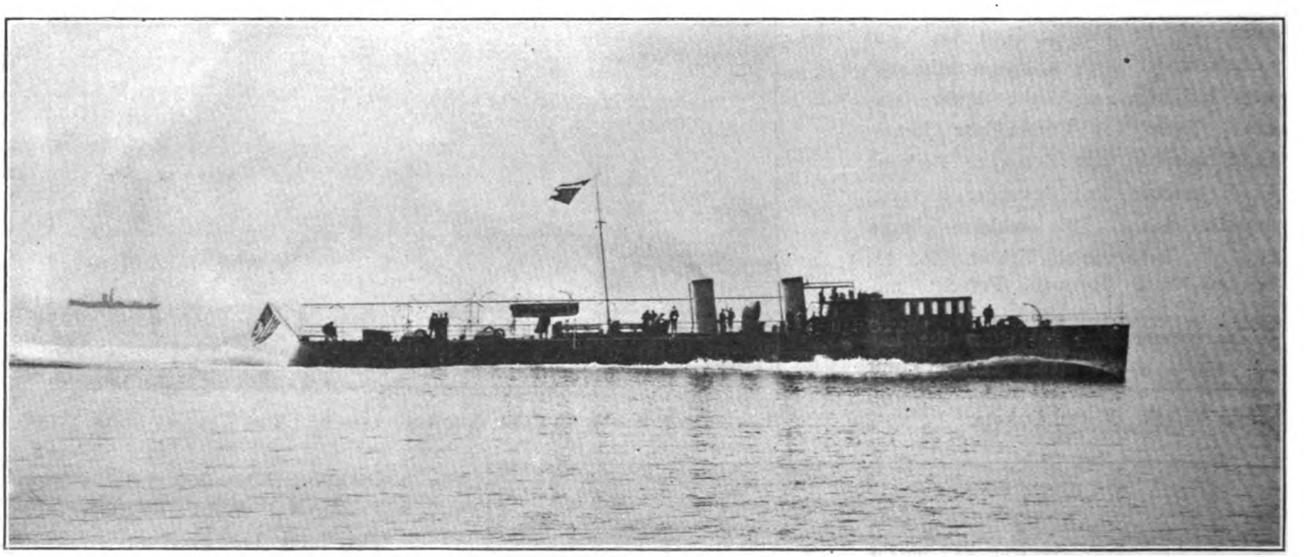
	1/5 power.	2/5 power.	3/5 power.	4/5 power.	Full power.
Duration of trial, hours	8	8	24	6	6
Steam chest press. gage	221	228	230	240	239
Quality of steam	Sat.	Sat.	35° Sup.	28° Sup.	53° Sup.
Exhaust shell vacuum, inches	28.1	27.5	27.2	26.4	25.7
R. P. M.	151.2	189.1	215.7	235.5	250.5
B. H. P.	5,077	10,077	15,730	20,978	27 142
Water per hour for main turbines	108,021	183,083	256 910	330,339	407,987
Water rate per B. H. P.	21.27	18.17	16.35	15.73	15.03
Available B. T. U. in steam	348	337	341.5	329	325.8
Efficiency of turbines, per cent	34.3	41.6	45.5	49.2	52
Water rate corrected to contract conditions.	....	16.76	....	....	13.83
Guaranteed water rate	....	17	....	....	15

as were used in going ahead. The turbines ran reversed at 186.3 revolutions and developed 11,035 B. H. P. Also the general maneuvering qualities of the vessel were excellent.

The Fore River Ship Building Co. have also supplied Curtis turbines for the battleship Aki, and Japanese yards are building Curtis turbines for two other battleships and three scout cruisers; two of the latter were ordered as a result of the successful outcome of the Ibuki trials.

Each of the turbines of the Ibuki has seven ahead wheels and two reverse wheels, all in one casing, and each in a compartment formed by diaphragms inside the casing. The first ahead wheel and each of the reverse wheels has four rows of moving buckets, while the remaining wheels have three rows each. The steam leaving any wheel is directed through nozzles in the diaphragms onto the buckets of the next wheel. The turbines are reversed by simply shutting off steam from the ahead steam chest and opening the valve to the astern steam chest.

The above turbines of the Ibuki are similar to those on the United States scout cruiser Salem, except their pitch diameter is 2 ft. greater.



THE CLYDE-BUILT AMERICAN YACHT WINCHESTER.

The accommodation for the owner, which is below deck abaft the machinery space and is very commodious and handsomely decorated, consists of a double stateroom, two single staterooms, drawing room, bath room and toilet rooms. There is a teak deck house forward 25 ft. long, containing dining room, captain's cabin, and pantry. The quarters for the officers and crew, and the galley are below the main deck forward.

The vessel has a complete electric light installation and is heated by steam.

The contract guarantees were made on a basis of 250 lb. steam pressure, and 28 in. vacuum at 200 revolutions for two-fifths power, and 255 revolutions at full power. The actual trial conditions were somewhat under these, and the corrected water rates in the table are to allow for the differences.

The reversing power of the turbines was tested at the end of the four-fifths power run by running astern for 15 minutes, keeping the same firing interval and conditions in the boiler room

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Transmission of Intelligence on Steam Vessels.

By H. A. Hornor, Electrical Engineer, New York Ship Building Co.

III.

Retrospectively the development of the telephone on battleships is remarkable. As late as 1903 a few telephones of the commercial type were installed merely as a matter of experiment. They consisted simply of a box telephone with transmitter and receiver on a hook such as were prevalent in office buildings, incased in brass for protection in exposed places. Their use was purely a matter of convenience, doubtless little reliance being ascribed to them. The patents covered by the Bell Telephone Co. nearing proscription, other parties began experiments for a suitable telephone for marine purposes. The question had not been largely discussed nor experimentation fruitful. However, one observation, that of noises within the vessel, conspired to the design of a telephone which would by its volume, or intensification of the human voice, and by the exclusion of external noises compass the solution of the problem. This type of telephone was designed, as had been its predecessors, to mount on bulkheads. All portable receivers were discarded and the instrument performed its functions with as little human aid as possible. Double receivers to exclude sounds other than the established circuit would permit were an important adjunct to the water tight type. The non-water tight type, as explained previously, could speak so audibly that it was unnecessary to place the ear to the receiver or to hold the lips near to the transmitter. The receivers were wound for a low resistance, so that the energy necessary was that of a few batteries, usually five. These telephones supplied communication for the general service, and were therefore interconnected as desired by a water tight telephone switchboard located in the central station. This telephone switchboard is interesting. It is still employed. No cords or plugs or jacks can be found on it. This will probably surprise our telephone engineers. All the interconnections are made by small "throw-over" or "tumbler" switches. Other features of the board are recognizable, night bell, visual drops, clearing out drops, operator's head set, etc. The circuits were divided up into groups of five, which for a 40-line board and the general use of the system on shipboard was found to be ample.

Types of Telephones.

But to return to the telephones. It was early pointed out that though ships' noises did affect the hearing qualities, vibrations transmitted to the various bulkheads acted more to their disparagement and disuse. Coupled with the interferences of the proper hearing qualities, came the effect of the packing of the carbon granules in the transmitters. These two salient objections told upon the advantages thought to be realized in this excellently made telephone and led to the types now specified and installed. No stint of praise should be allowed to the achievement of the "loud-speaking" telephones, for in their passing they have confirmed the telephone for yet greater service—that of controlling the engines of war. So the order was issued that all telephones must be taken off of bulkheads; no more low-resistance receivers; back to the standard voltage in commercial practice and back to a simple two-wire system. From a system depending only on batteries without any intervening coils, emerges a system replete with condensers, induction coils, alternating current ringer, etc. Another step in advance breaks up the whole into four distinct divisions: A general telephone system for the convenience of the officers; a special and independent set of circuits connecting the fire rooms and engine rooms; another special circuit between the engine room and the bridge; and last, but by far the mightiest, an elaborate system for the control of the guns during battle.

Operation of the Telephone.

In the officers' state rooms and compartments, where the telephone is not subject to exposure, the hand telephone set consisting of one transmitter and one receiver is suspended when not in use from a water tight case which contains the condenser and bell mechanism. The act of taking the telephone down for use, or returning it thereafter, automatically operates a switch on the top of the case which establishes the circuit to the switchboard. The water tight telephone is similar in operation, differing only in that the telephone hand set is inclosed in a stowage box; when this is opened the circuit is established to the switchboard. The telephones connecting the fire rooms and engine rooms are like the water tight type used on the general telephone system with this difference, that no bells are provided. The system does not pass through the telephone switchboard, and therefore the calling apparatus is taken from the general interior communication system, consisting of direct-current bells and push buttons. The circuits between the bridge and engine room are direct, as in the latter system, having no connection whatever with the general telephone system. The telephones are exactly the same as those installed for gun control. The live wires are brought to a terminal in a brass box, which serves as a permanent fixture wherein to stow the telephone set. A portable twin wire is led to two receivers wired in multiple arranged to fit comfortably on the head. By means of a hard rubber plug and jack cut into the portable twin conductor a breast type of transmitter may be introduced to complete the outfit. This permits the use of the hands and produces continuous communications. The breast transmitter has a vertical adjustment of 3 in., a back and forward movement of 30 degrees and a side movement of 180 degrees. Energy is supplied to all of these systems, including the battle telephones, through a transfer panel located in the central station. There is further provided for the bridge and engine telephone circuits a transfer switch, so that the exposed circuit to the bridge may be cut out in case the bridge is destroyed in action, and communication safely maintained from the central station. It would only weary the reader to describe each and every sub-division of battle telephone system unless he were deeply interested in military questions. Such information he would hardly seek from this paper. As nearly every battleship differs as to her complement of guns, their arrangement or caliber, it is evident that a description of one particular vessel would not apply to others. Suffice it to add, therefore, that in general there will be found a separate and complete system for the guns of large size mounted in turrets; one for the secondary battery (or torpedo-defense guns); one for searchlights which are necessary for torpedo defense at night; one for torpedo firing; and one for the exclusive use of the range-officer. The utilization of these battle telephones will be more clearly appreciated when shown later in conjunction

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with their correlated system of fire control.

Fire Alarm System.

Of the systems which are not actually necessary for military operations unquestionably the fire alarm system is the most important. Until recently metallic thermostats, acting upon the difference of the expansion of two dissimilar metals, were installed in all the coal bunkers, magazine and storerooms; but this type has been found deficient in many ways and so has been superseded by a simple mercurial type. The circuits from the thermostats are all led to annunciators constructed like those for the call-bell system, having as an auxiliary a switch for each line in order that the bell may be cut out of circuit after an alarm has been given.

The general alarm gong system, consisting of two or three contact-makers and 30 odd 12-in. electric gongs, serves the purpose of calling the crew to drill or arms or giving an alarm in case of danger.

The purpose of anchor handling and boat hour gongs is implied in their names. The gongs are usually 8 in. in diameter and are actuated by push-buttons. The former give directions from the forecastle deck for the control of the anchor windlass engine; the latter provide a call notice to the officers' quarters that the shore-cutter is ready to depart.

Warning for Closing Watertight Doors.

A warning is provided for the closing of all watertight doors in cases of collision. The necessity here is for a sound that will be distinguishable from the noises of the machinery. The first means devised and one long used was that of an electric magnet compressing enough air and allowing it to escape through a shrill whistle. The sound produced greatly resembled the familiar chirp of the cricket. This has now been superseded by what is known as the electric "howler." A magnet actuates a hammer against a tight pigskin diaphragm, the noise being intensified by a horn such as seen on automobiles. The sound is not as shrill as the whistles, but is sufficiently differentiated from the ship noises to be entirely satisfactory.

System of Gun Control.

In vessels carrying oil for fuel it becomes evident that some indication must be given as to the height of the oil in the tanks when filling same. An ordinary float in the tank provides the switch for closing the necessary circuits. Indications are shown on an annunciator of the ordinary type.

It is essential among the systems purely for the control of the guns that primarily provision be made to quickly handle the ammunition. For the large turret guns it has been explained that mechanical signals are employed. In the case of the secondary battery, although voice-tubes allow verbal signals to be transmitted, there has lately been installed a system designated as broadside ammunition hoist signals. The indicators consist of a simple brass water-tight case with round white discs properly marked and illuminated by 5-candle power incandescent lamps. The markings provide for signals to hoist, lower and stop as well as to determine the kind of ammunition desired. Transmitters consist of several standard switches mounted in one case and properly designated. As a check a similar indicator is installed at the loading end of the hoist and the lamps wired in series, the transmitter with indicator being located at the upper or receiving end of the hoist.

In order that the turret guns and secondary battery may fire a broadside simultaneously, systems of bells, buzzers and contact makers have been designed. These systems have been nominated respectively for the turret guns —turret salvo-firing, and for the smaller guns—broadside salvo-firing. Small 3-in. electric bells are permanently installed in and about the guns so as to be distinctly audible; they give the order to "stand by." Portable buzzers strapped to the chests of the gunners are operated by push-buttons and give the signal to "fire." The contact makers and push-buttons are located at the two principal fighting-tops, the captain's battle station and the sub-stations. The point interesting to note in this system is that of strapping the buzzers to the gunners. This is done in order that there can be no mistake in the interpretation of the signals, for though it may not be audible, the vibrations of the buzzer will be communicated to the body.

Cease Firing System.

The cease-firing system is identical to the general alarm system. The diameter of the gongs for this system is made 10 in. instead of 12 in. On some battleships in order to better differentiate the sound one system will have vibratory gongs, the other single-stroke. This system provides signals to commence and cease firing and pervades the entire vessel. Thus it is a general gun signal.

At the present writing the actual electric firing of the guns from the vessel's electric plant has never been required. The guns are provided with a local battery system and the consideration today is not only to retain this means, but also to provide a similar system taken from the vessel's permanent installation. Special motor generators are to be designed so that only the requisite voltage and current will be delivered to the guns. Switches of a portable type, resceptacles for connection at the guns and other necessary appliances will be furnished. No details have yet been considered, and it is problematical whether such a system will not in the end find much objection in the opinion of those vitally concerned.

Morale in Warfare.

Morale in warfare is an important factor. The enemy must be more or less affected by what he estimates as the fighting strength of his opponent, or what the latter may hold in reserve as reinforcement. So there are retained in our large battleships at least two torpedo tubes. From stations located on the superstructure deck the firing of the torpedoes is not only directed but actually accomplished. Firing keys, not unlike telegraph keys, are located at these firing stations in conjunction with signals that permit no complication before the firing keys are actuated.

To give the necessary directive action to the torpedoes a system of telegraph indicators and transmitters of the lamp pattern, as described under the head of electric engine revolution and electric steering telegraphs, is installed—one transmitter at each torpedo firing station with indicators at each torpedo tube. These transmitters indicate at the torpedo tubes the number of degrees from zero center reading to 90 degrees port and starboard. This system bears the natural title of the gyro-indicator system, as by this means the torpedo gyroscope is so adjusted.

(To be continued.)

The Maryland Steel Co. at Baltimore expects to have the naval collier Hector ready for preliminary trials within the next 30 days. The Vulcan and Mars have already been delivered and the fourth and largest will soon be ready to lay down in the mold loft.

The new tug George P. Murray, recently launched at Cooper's Point, Camden, N. J., has just received her official papers and will engage in towing in Delaware river and bay. She is the only wooden tug that has been built at Camden for 10 years.

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Great Lakes Engineering Works are 600-footers for the Pittsburg Steamship Co., to be practically duplicates of the Thomas F. Cole. In part payment for this construction the Great Lakes Engineering Works has taken over seven of the old whaleback barges belonging to the Pittsburg Steamship Co., namely 117, 118, 130, 131, 132, 133 and 134. It is understood that the barges are to go to the coast. They will have to be cut in two, however, to pass through the Canadian canals, though no difficulty is offered on the score of beam.

SEPTEMBER LAKE LEVELS.

The United States Lake Survey reports the stages of the great lakes for the month of September, 1909, as follows:

Lakes.	Ft. above tide-water, New York.
Superior	602.39
Michigan-Huron	580.82
Erie	572.38
Ontario	246.28

Since last month, Lake Superior has fallen ¼ in., Lakes Michigan-Huron 2¾ in., Lake Erie 5 in., and Lake Ontario 6½ in.

During October, Lake Superior is likely to fall ¼ in., Lakes Michigan-Huron 2¾ in., Lake Erie 3 in., and Lake Ontario 4¼ in.

Lake Superior is 9 in. lower than the average September stage of the past 10 years and about 4½ inches lower than last year. It is 6 in. higher than in September, 1891, but 13½ in. lower than in September, 1899, and 11¼ in. lower than in September, 1905.

Lakes Michigan-Huron are 2½ in. lower than the average September stage of the past 10 years and 5½ in. lower than last year, but 13 in. higher than September, 1896. In September, 1885, the water was 29 in. higher.

Lake Erie is exactly at the mean September stage of the past 10 years and 3½ in. lower than in September of last year, but is 13¼ in. higher than in 1895. It is 18¾ in. lower than in September, 1876, and 17 in. lower than in September, 1885.

Lake Ontario is 3 in. higher than the average September stage of the past 10 years but 10¼ in. lower than in September last year. In 1870, it was 12 in. higher, and in 1883 it was 13 in. higher than in 1909. In September, 1895, it was 27¼ in. lower than this year.

CHICAGO RIVER TUNNEL.

The contract for the new Washington street tunnel, under the south branch of the Chicago river, at Chicago, has been let to George W. Jackson, Inc., Chicago, and work on it will be commenced in 30 days. The main section of the tunnel extends from Canal street to Franklin street, a distance of 1,200 feet, and the contract price is $590,000. The La Salle street tunnel is progressing, and the Van Buren street tunnel is completed. In the latter, the rails for the street cars will be laid in a few weeks. The purpose of the tunnels is to relieve congestion on the bridges, and to prevent delays to street car traffic on account of being "bridged". The old tunnels interfered with navigation of the Chicago river, and the government ordered them lowered.

CONVERSATION ON A LAKE PASSENGER STEAMER.

The following conversation took place on the day boat between Cleveland and Detroit. The trip had been very dull from Cleveland across the lake, and consequently one was willing to listen to anything in order to pass the time away, for one cannot read forever. The steamer had just come in sight of Point Pelee when a party of five sat down in front of the writer and for the balance of the trip he had no lack of entertainment.

There were three men and two women in the party, and the men were trying to show the women how much they knew about marine affairs.

"O, see that land away off there," said one of the women. "That," replied man No. 1, who seemed to know more about such things than the other two, as they constantly referred all obscure points to him, "that is Point Pelee, the most dangerous point on the great lakes. More vessels go ashore there than on all the rest of the lakes put together."

"I wonder what that boat is doing out there", said man No. 2. "That is one of those Canadian warships watching for American fishermen," said No. 1, nodding towards the lightship, "and that's why she isn't going fast enough to make a swell."

A freighter trailing a log line passed just now.

"What's that rope out behind her for?" asked one of the women.

"O, they're trolling for fish," said wise No. 1 again. "That's the way they get the food for the crew. Sometimes they get enormous quantities of fish that way and have to throw some away."

It was now No. 3's turn to effervesce some information.

"You see that water coming out of that boat just in front of where that man is looking out?" said he. "Well, that water is coming out of the hold of the ship. These big new steel boats always leak a lot of water. You know they can't make a steel boat perfectly tight like a wooden ship. The plates are so thin that the oakum, (that's the stuff they force in between the plates to keep the water out) won't stay in very long. The plates are only about two inches thick."

"Goodness," said one of the women, "how can people be so daring as to go on board such leaky things."

The water referred to was the discharge from the air pump.

"Is that boat loaded?" asked one of the women.

"No", said No. 2, looking at a freighter with her anchor awash, "when a boat is loaded, the water nearly flows over her deck."

"What makes that water foam in front of her like that?" was asked. "O, that's the wind coming against her bow," returned learned No. 2, "I have seen that go half way up the bow. The boat I'm thinking of had just passed ours and the wind from our boat made it splash away up her bow."

"That's Canada over there, isn't it?" one of the men asked No. 1.

"Yes," he answered. "Then do we go into Canadian waters, before we get to Detroit?" he continued.

"No sirree, you bet we don't," promptly answered No. 1. "If we went into Canadian waters right here that battleship back there would fire on us right quick, you bet."

"Why is that," he was asked.

"O, it's just a quarrel that the United States Congressman Burton (he's the fellow from the Cleveland district) had with some of the members of parliament of Canada, and so they forbid American vessels to sail in Canadian waters."

ROCK AND GRAVEL SHOALS OFF CHICAGO LAKE FRONT.

The U. S. Lake Survey steamer Search, which is engaged in sweeping the lake front off Chicago, Ill., reports the existence of a shoal area of sand and gravel with outcropping rock, lying to the northward of Lakeview Waterworks Crib. Depths of 24 feet and less, at existing stage, prevail over this area, which extends 3½ miles easterly from the lake shore at Rogers Park, with the north and south limits 4½ miles and 2 miles, respectively, north of Lakeview crib.

A few of the least depths found at the time of the sweeping are located

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as follows, bearings and distance being given from Lakeview crib:

						Feet.
17.5	N.	13°	W	(Azimuth	347°),	10,600
19.6	N.	5°	W.	(Azimuth	355°),	13,400
21.3	N.	8°	E.	(Azimuth	8°),	14,500
22.5	N.	11°	E.	(Azimuth	11°),	19,400*
20.3	N.	5½°	W.	(Azimuth	354½°),	21,500
22.0	N.			(Azimuth	0°),	23,500
19.0	N.	20°	W.	(Azimuth	340°),	20,200

*Wreck.

Masters of deep laden vessels are cautioned to keep at least 4 miles from shore while navigating in this vicinity.

NEW ORE LOADING RECORD.

A new ore loading record was established at Two Harbors on Sunday, Oct. 10, when 10,111 gross tons of Pioneer ore from the Vermillion range was loaded upon the steamer Wm. E. Corey in 39 minutes. This time includes all delays, the boat starting at 2:17 and finishing at 2:56. This record was made possible in part by the use of the new Summers steel ore cars. Recent tests with the most refractory ore showed that these cars could dump their cargo of 50 tons in 45 seconds, as against about 7½ minutes by the ordinary type car.

AROUND THE GREAT LAKES.

Ore receipts at Ashtabula for September were 1,432,394 tons, the largest ever reported.

President Livingstone of the Lake Carriers' Association announces the membership of the welfare plan to be now 8,430.

The steamer Yosemite hit the overhead feed wires of the Newburg & South Shore Railroad bridge and broke her top mast.

The Anchor Line steamers Juniata and Tionesta have finished their passenger season and are now running on the regular fall schedule.

John Swedenberg, a foreman on the Pennsylvania docks, has been appointed harbormaster at Ashtabula to succeed Sam F. Cook, resigned.

Plans have been prepared by the Detroit, Belle Isle & Windsor Ferry Co. for a new excursion steamer somewhat similar to the Brittania.

The package freighter North Star, building for the Mutual Transit Co. at the St. Clair yard of the Great Lakes Engineering Works, was launched on Oct. 2.

The fish tug George Edwards, building for Reger & Werner, of Lorain, was launched at Buffalo on Wednesday, Sept. 22. The new tug is 75 ft. long and 16 ft. beam.

The steamer Lackawanna, which was sunk at Port Huron by the barge Chieftain, was taken to Detroit for temporary repairs. She will go to Buffalo for permanent repairs.

Contract for an all steel lighter to be delivered next spring has been let by the Western Transit Co., of Buffalo, to the Manitowoc Dry Dock Co., Manitowoc, Wis. She will be stationed at Duluth in place of the old wooden lighter Gray Oak.

With a view of establishing a life saving station at Toledo, General Superintendent Kimball of the life saving service has been ordered to proceed to Buffalo where a conference with Lieut. Commander Stearns, United States naval inspector of the tenth light-house district, will be held.

The Great Lakes Towing Co.'s new tug E. M. Pierce, which was built by the company at its own yard in Cleveland, has been delivered at Lorain. The tug is constructed entirely of steel as it is intended for work all year around. The Pierce is 80 ft. long and 19 ft. beam.

The mail boat C. F. Bielman Jr., delivered 67,147 pieces of mail to vessels passing Detroit during September, at the same time taking from the boats 31,394 pieces. The biggest day's work was on Sunday, Sept. 26, when mail was delivered to 104 boats between the hours of 6 a. m. and 6 p. m.

The Carnegie Dock & Fuel Co., which has leased the old Great Northern dock at Duluth, intends to rebuild it during the winter and to extend it 1,000 ft., making it 2,000 ft. long. This will give the Carnegie Company, when completed, the largest dock in point of storage capacity at the head of the lakes.

The two 600-footers building at the Lorain yard of the American Ship Building Co. for the Pittsburg Steamship Co., will be named in honor of William B. Schiller, president of the National Tube Co., and John P. Morgan Jr., member of the finance committee of the United States Steel Corporation. The Schiller will be launched on Oct. 23.

The Polson Iron Works Co., at Toronto, has entered into an agreement with the city of Owen Sound to operate upon a percentage basis a dry dock to be constructed there. The people of Owen Sound are anxious to have a ship repair plant established at that port and propose to build a 400-ft. dry dock which can be extended if necessary.

The Lake Shore Railway, which has been engaged for the past three years in extensive improvements at Ashtabula, has decided to equip its new extension dock No. 2 on the lake front with the same equipment as No. 1, that is to say, four Hulett unloaders with 15-ton buckets and Hoover & Mason conveying bridges. The new dock is to be ready for business by September 1, 1910.

The fall advance of wages on vessels enrolled in the Lake Carriers' Association went into effect on Oct. 1. The advance affects all classes except licensed officers and first cooks. The new schedule is as follows: Second cooks and waiters, $37.50 per month; porters, $35; firemen, oilers and water-tenders, $65; wheelsmen and lookouts, $65; ordinary seamen, $40; able bodied seamen, $65.

Capt. James Stone, supervising inspector of steamboats, has rendered his decision in the collision between the steamer City of Erie and the Canadian schooner Sir C. T. Van Straubenzie off Dunkirk on Monday morning last, in which two men and one woman were drowned. In his report Capt. Stone finds that the schooner's starboard or green light was not burning, and therefore holds the pilot of the City of Erie, Edward S. Picket, blameless.

President Livingstone, of the Lake Carriers' Association, has arranged to have the same lights installed on the north pier at Duluth as were in the service last year at the close of the passenger season at that port. These lights, which are now in commission, consist of a cluster of six lights, carried on three iron lamp posts at the outer end of the pier, each of the posts carrying a white and a green light 4 ft. apart. Two of the posts stand on the pier with lights 28 ft. above the lake surface, while the third post will be on a lower portion of the pier with lights 20 ft. above the lake.

OBITUARY.

William Moran, member of the firm of Moran Bros., which built the battleship Nebraska, died at Seattle on Sept. 13. He is the fourth of the eight Moran brothers to die within four years.

Capt. Thomas Banner, who died at the home of his niece, Mrs. John Downing, 387 Fulton street, Buffalo, was a well known figure on the great lakes some years ago, having sailed quite a number of vessels. He came to this country in 1844, settling at Buffalo and identifying himself with the lakes sailing. He is survived by his son, Thomas B. Banner, of Chicago.

William H. Palmer, head of the firm controlling the largest fleet of coasting schooners in the world, died on Sept. 29 at his home in Roxbury,

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Mass. Mr. Palmer was 50 years of age. A wife and two children survive. The Palmer fleet of vessels is known the length of the Atlantic seaboard, not only because of its aggregate size, but because of the individual proportions of a number of the vessels. Five masters always appealed to Mr. Palmer as the best carriers, and this type he made prominent. The Elizabeth Palmer of 2,500 tons is the largest five-masted schooner in the world.

Alexander McVittie, president of the Toledo Ship Building Co., died at his summer home at Harbor Beach of heart failure on Sept. 15. He was born in Dumfrieshire, Scotland, in 1842. When a child his parents emigrated to Western Ontario, where his father died shortly thereafter, leaving the mother to carry on the work of the farm with the assistance of her young sons. His first position was that of errand boy in a general store. He later engaged in a general mercantile business with his brother-in-law, and for a time entered the oil business in Rothwell, Ont. He was still a young man when he went to Detroit and secured a position as time-keeper at Campbell & Owen's dry dock. He showed a natural aptitude for the business and his advance was steady. When the Detroit Dry Dock Co. was organized he was made its manager. Later he held successively the positions of secretary, treasurer, vice president and president of the Detroit Ship Building Co. Three years ago he associated himself with interests which purchased the old Craig yard at Toledo, forming the Toledo Ship Building Co., of which he was president and assistant treasurer. Mr. McVittie was decidedly domestic in his taste and lived a most exemplary life, deriving his major pleasure during middle age from his stock farm. He was a man of broad general information and liberal views, extremely charitable in a quiet way and an out-spoken advocate of temperance.

William Watson, chairman of the Cunard Steamship Co., died on Oct. 4 at his residence, Brombrough, Cheshire, England, in the sixty-seventh year of his age. Mr. Watson was born, educated and made his early business success in Charleston, S. C., and later took up his residence in England. He was for many years prominent in the cotton trade at Liverpool, where he amassed a fortune under the firm name of Watson & Co., of which he was the senior member and from which he retired a few years ago. He became a director of the Cunard Steamship Co. about 16 years ago, later vice chairman, and upon the death of the late Lord Inverclyde in 1905 was elected chairman, which position he filled with credit and distinction to himself and to the great advantage of the company, holding that position to the time of his death. He carried to successful completion the building of the two famous steamers Mauretania and Lusitania, which had been conceived and started by the former chairman, the late Lord Inverclyde. A man of gracious manner, splendid business ability, great energy and of sterling character, Mr. Watson commanded the respect and confidence of all who had dealings with him.

C. SHERMAN HOYT JOINS THE WELIN DAVIT CO.

At a directors' meeting at the offices of the Welin Davit and Lane & DeGroot Co., Cons., at 17 Battery place, New York, C. Sherman Hoyt, naval architect and marine engineer, and for the last year or two inspecting engineer for the Panama Railroad & Steamship Co., was elected secretary and treasurer of the Welin Davit and Lane & De Groot Co., Consolidated. Mr. Hoyt will in future take an active part in the affairs of this company, as a member of the firm, both as to the financing as well as the execution of its general business. Capt. John C. Silva, who has resigned from the position of secretary and treasurer which he held heretofore, is still one of the board of directors of the company and will in future hold the office of general sales agent. He is about to leave for an extended trip to the Gulf states where he will attend the National Bar Pilots meeting at New Orleans and will thoroughly look into business conditions in the various ports of that district.

A survey of the Cunard steamer Lucania, which was burned at the Liverpool docks, London, revealed that the vessel could not be repaired at a cost within her insurance, which was $600,000. A unique settlement was reached, whereby the Cunard company accepted $500,000 and retained the hull of the Lucania. It is now reported that the company has sold the hull to Ward, of Sheffield, for $150,000, for breaking up purposes and thus passes out of existence a steamer that for many years held the trans-Atlantic record and was the favorite of all trans-Atlantic passengers.

NEW LIDGERWOOD STEERING ENGINES.

It was more than 35 years ago that the Lidgerwood Manufacturing Co first built steering engines. The earliest engines sold for this use aboard ship were of the rotary type. A glance at the early records kept by Gen. Supt. John V. Beekman, show that between March and July, in 1872, Col. W. H. Mallory bought three of these rotary steering engines of various sizes for use on his vessels. The first Lidgerwood steering engine of the reciprocating type was built for the Long Island Sound steamer Rhode Island, in the spring of 1877. This was made to replace an engine of the rotary type which had been specially made by the company to please Capt. Jones, of the Rhode Island, and was constructed entirely of composition metal. This metal, however, did not prove satisfactory for the purpose. Other vessels which were equipped with Lidgerwood steering engines at about this same time were the City of Alexandria and the City of Washington, of the Alexander line, and a considerable number built by the Cramps on the Delaware.

Another place of note where a Lidgerwood steering engine was used was in the Pennsylvania ferryboat Baltimore, which ran from New York city to Jersey City. These engines of a generation ago embodied the essential features of the modern steering engines and were used in many cases until the vessels were broken up.

In one instance which has recently come to the knowledge of the company, the steering engine, after having been used until the vessel was condemned and broken up, was taken out and put into service as a hoisting engine, and it is still doing daily service in that capacity.

The business of building these engines languished, however, because although vessel owners were desirous of using them the old-time captains and pilots were opposed to their use. The old timer didn't feel safe unless he could "feel" the rudder directly through the tiller or wheel.

The rapid development of the contractors' hoists business soon had the facilities of the Lidgerwood works taxed to their utmost, and no effort was made by the company to push the sales of steering engines. The company having recently established a marine department, is now building a line of steering engines of approved design, one type of which is shown in the accompanying cut.

It will be seen that the engine is not a radical departure in design from

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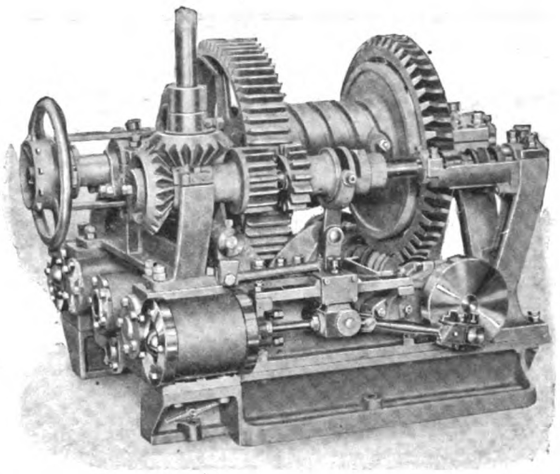


NEW LIDGERWOOD COMBINED STEAM AND HAND STEERING ENGINE.
(PATENTS APPLIED FOR.)

those now in general use. It does, however, contain a number of important features which will be appreciated by practical men as going a long way towards making the machine most desirable. Two of these features are clearly shown in the cut.

The first is the introduction of the Lidgerwood standard gib and key connecting rod in place of the old-fashioned yoke and shim arrangement. The other is the introduction of the Lidgerwood standard locomotive type of crosshead and guide instead of the old style plug crosshead and barrel guide.

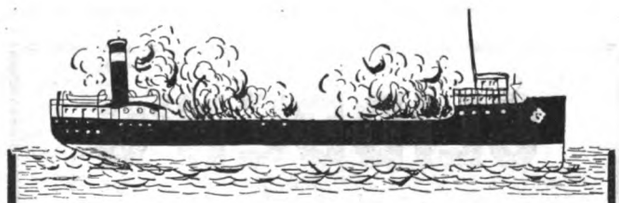
The application of these features is not new for ship work, they having been used extensively on ship winches for a number of years of the steamship lines of this and other countries.

The arrangement is such as to permit of the easy adjustment for wear, thereby obviating the disagreeable noise which frequently arises from steering engines after they have been in use for a short while. Great care has been taken in designing the machine so as to obtain the maximum strength of parts where it is most required. The engine is exceedingly compact and arranged for easy inspection and adjustment and will commend itself to all who believe that the best engine obtainable is none too good for steering purposes.

The machine is built from new patterns in which all the improvements suggested by an extended experience and observation are embodied. The engine illustrated is of the combined steam and hand steering type. The company also builds a "steam only" type of engine, and a screw-gear engine for large ships.

All of these engines are built on the same general lines and under the Lidgerwood system of duplicate parts, which insures absolute accuracy and at the same time makes it possible at any time to promptly procure repair parts which can be put into place at once without requiring any work in fitting.

A maximum speed of 34.548 knots is reported to have been achieved by the torpedo boat destroyer Reid in her builder's trial on Oct. 6.



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